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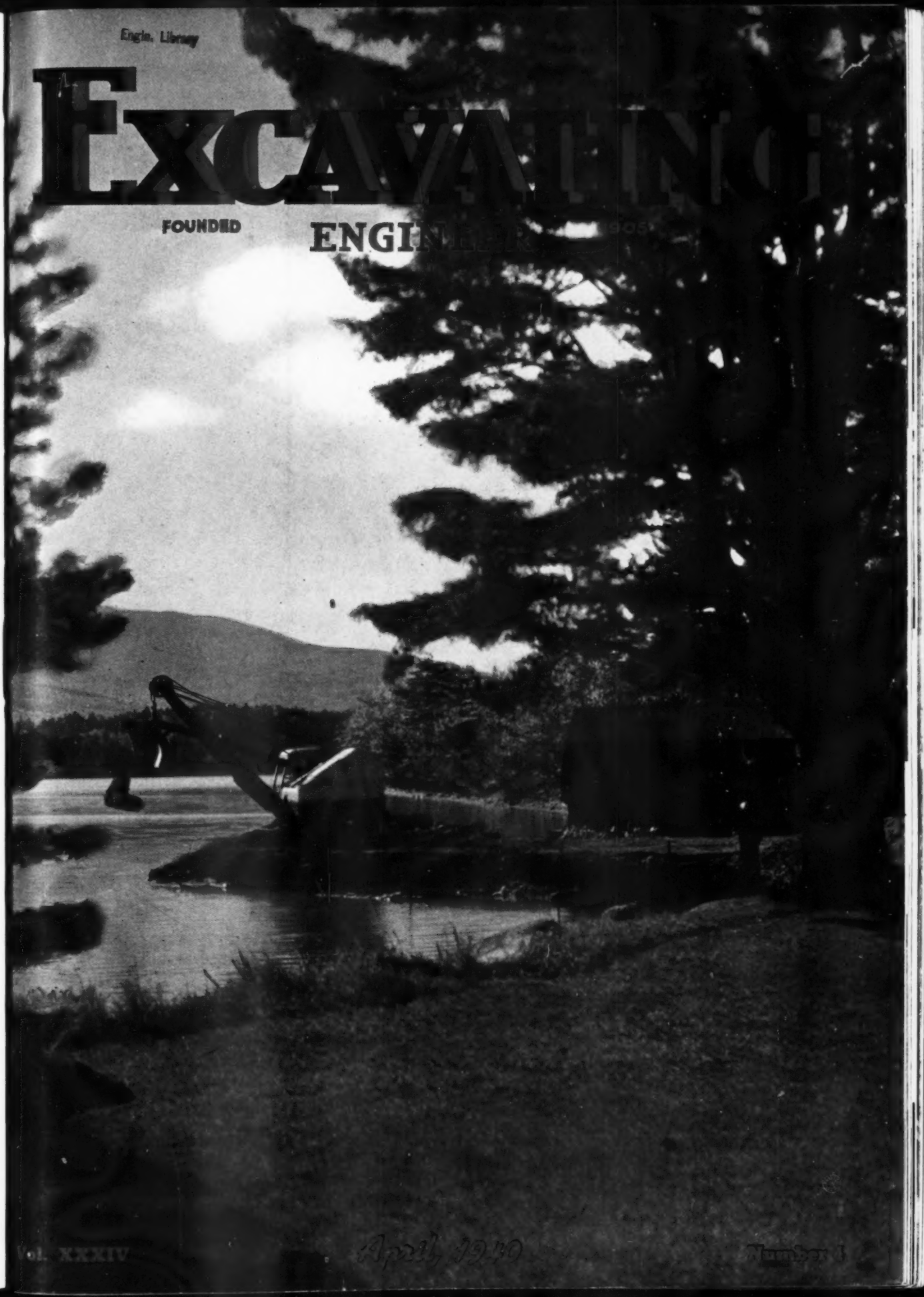

Vol. XXXIV April 1940 Number 4

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TAPERED ROLLER BEARINGS

EXCAVATING ENGINEER

FOUNDED 1905

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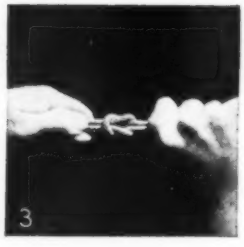

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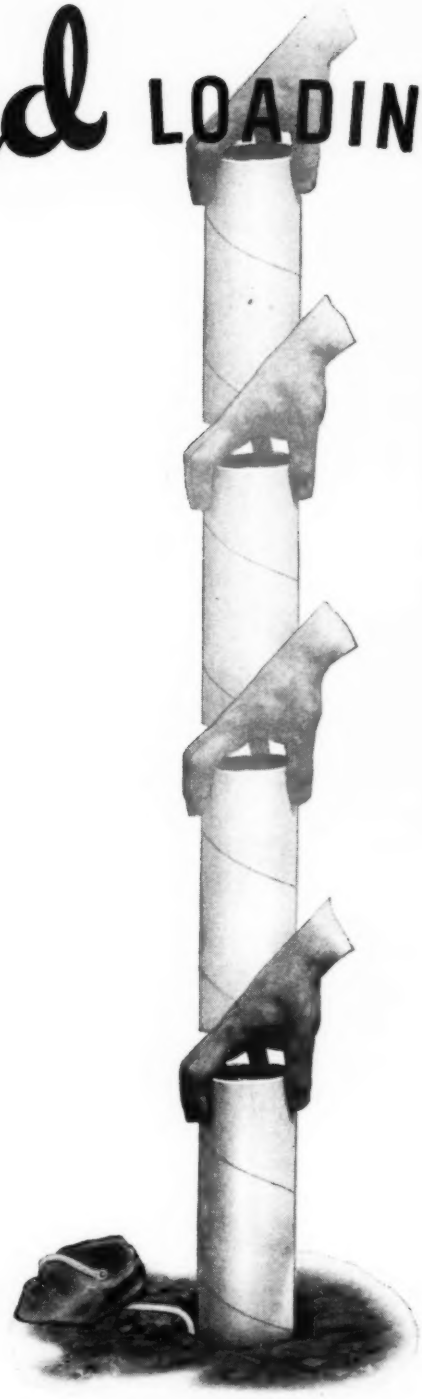

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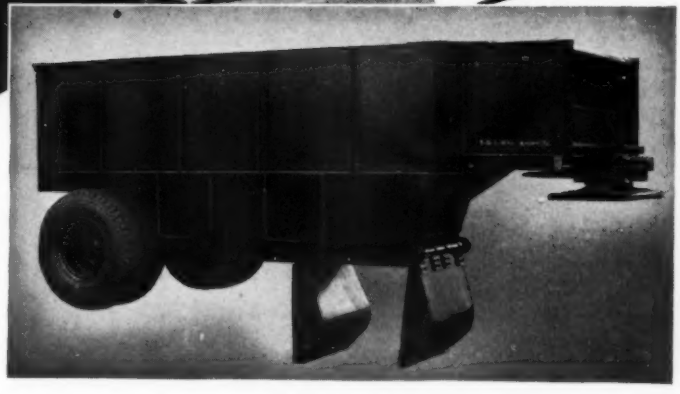

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HIWASSEE

HIWASSEE DAM

Completion of TVA's sixth construction project calls for 300,000 yards of excavation and the production of aggregate for 800,000 yards of cement.

By F. L. ENDEBROCK

Report Engineer, Tennessee Valley Authority

HIWASSEE DAM, the Tennessee Valley Authority's sixth construction project, is located on the Hiwassee River 75.8 miles above its junction with the Tennessee River. The entire project lies in Cherokee County, North Carolina, in the extreme southwest corner of the state. Preliminary investigations and foundation drilling commenced in June 1934. Construction was authorized by the Board of Directors of the Tennessee Valley Authority on January 10, 1936 and preliminary construction work was started in July, 1936.

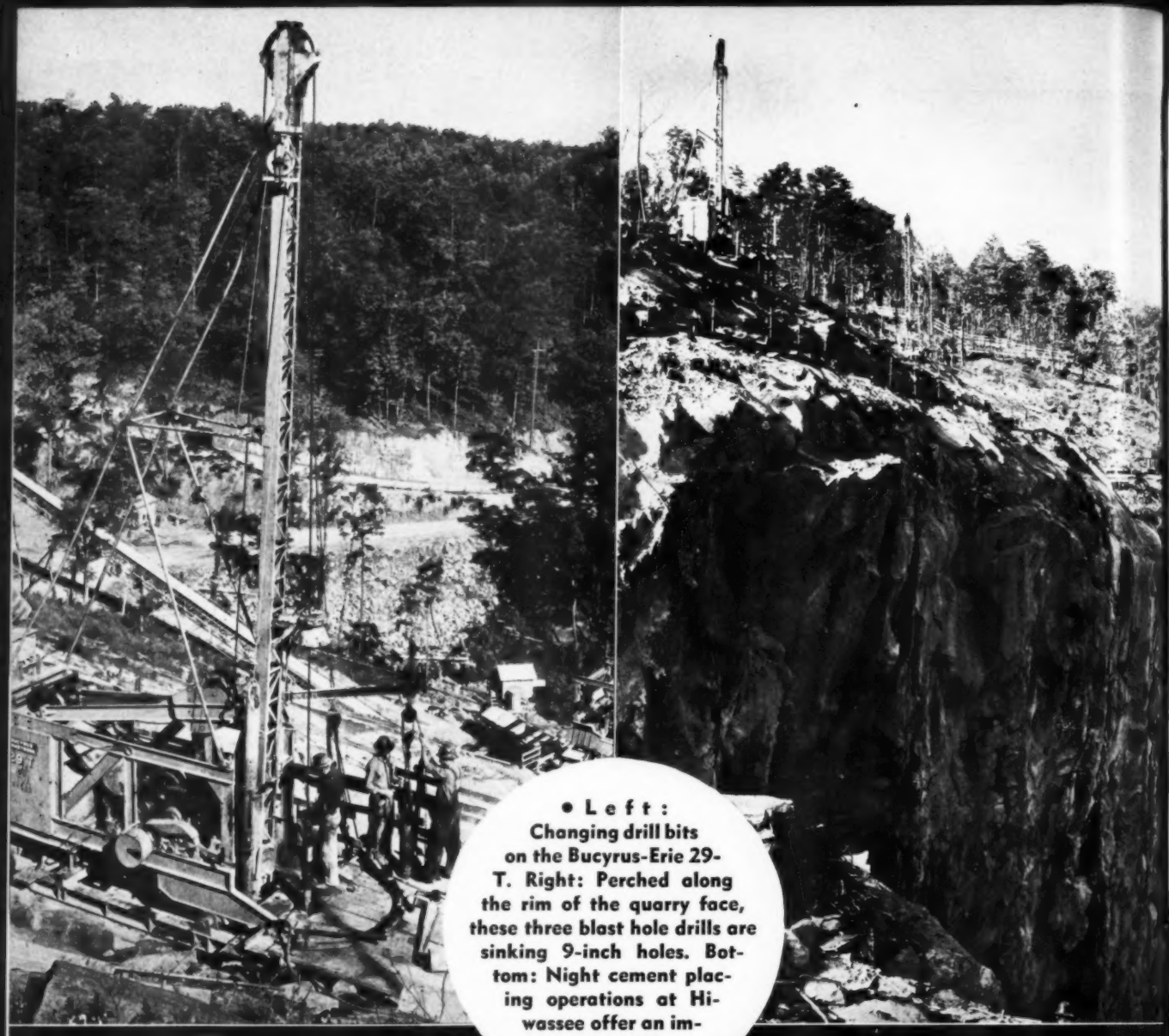
The dam will be a concrete structure of the straight gravity overflow type, 1,265 feet long at the top and 307.5 feet high (while this is the "rated" height or maximum straight line height of the dam, the distance from the lowest area in the foundation to the top of the dam exceeds this rated height by 14½ feet). A total of 794,439 cu. yd. of concrete will be required to complete the project. The spillway section, 260 feet wide, is located approximately over the natural river channel, and in the center of the structure. Seven radial gates each 23 feet high by 32 feet long will control the flow over the spillway crest. Four steel lined regulating conduits each 8'-6" in diameter are provided through the spillway section. One 102-in. ring seal gate controls the flow through each conduit. One emergency gate 12'-9" by 13'2" operated by a 120-ton gantry crane from the spillway bridge, will be available to serve any of the four regulating conduits in the event that any one ring seal gate may need repairs or be placed out of operation.

● General excavation operations in blocks 10 and 11 of the Hiwassee Dam spillway section.

Flow of 150,000 c.f.s. Possible

The crest of the spillway will be elevation 1,503.5 and the top of the gates 1,526.5. At flood elevation of 1,532 the spillway can pass a maximum flow of 130,000 c.f.s. which may be augmented with an additional 20,000 c.f.s. through the regulating conduits. A concrete apron and stilling basin is provided below the spillway to prevent erosion at the foot of the dam.

Two steel lined penstocks 18' inside diameter are provided through the intake section of the dam. Penstock No. 1 serves the initial 64,000 KVA generator now being installed. The second penstock, now closed with a steel hemispherical bulkhead, is provided for future installation. An intake gate 15'-2" by 25'-8½" c-c of seals operated either by stationary hoists over the penstock, or by the spillway gantry crane, is provided for emergency closure of the penstocks. The powerhouse is of the outdoor type with the generator protected by a cone shaped steel cover. Public rooms, operators' control room and offices are housed in a small control building. A 275-ton gantry crane serves the powerhouse. The switchyard contains a 154-KV, a 44-KV, and a 12.5-KV yard and is located on the adjacent hillside and across the service road from the powerhouse. Due to the steepness of the rock hillside the switchyard is benched out on



• **Left:** Changing drill bits on the Bucyrus-Erie 29-T. Right: Perched along the rim of the quarry face, these three blast hole drills are sinking 9-inch holes. Bottom: Night cement placing operations at Hiwassee offer an impressive sight.

three levels above the transformers, which are placed approximately the same level as the powerhouse approach road.

Upon completion, the normal water surface in the reservoir will be at elevation 1,526. A reservoir 22 miles long, with a shore line of 150 miles will provide a gross storage capacity of 434,800 acre feet at elevation 1,526. The drainage area above the dam is 968 square miles. The generally high altitude of the Hiwassee watershed is favored with an exceptionally heavy precipitation, averaging around 56 inches annually. The Hiwassee River is a typical mountain stream — winding, swift, and turbulent, with a rocky stream bed.

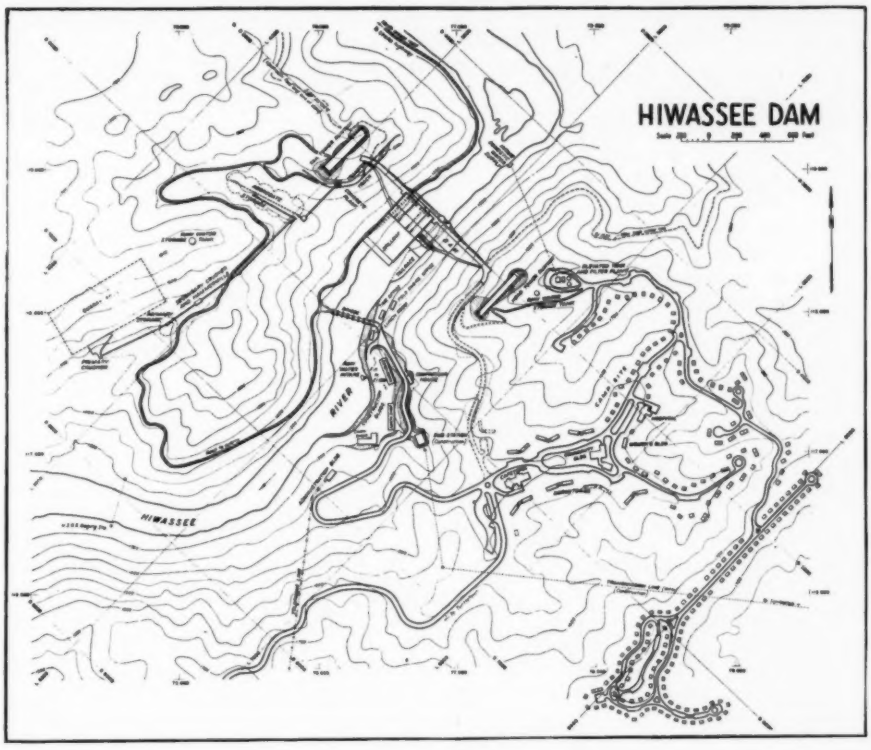
Hiwassee Dam has its functions to fulfill in the unified system of the Tennessee River developments. Like Norris, this is the second dam of the Tennessee Valley Authority to be built on a tributary river. The major navigation benefits resulting from the development of the Hiwassee River lie in the increase of low flows on the Tennessee River. Storage of excessive run-off during the rainy season permits increased flow in the dry season, thus reducing the fluctuations of water level in the main river dams.

Control of flood water on the Hiwassee River contributes materially to lowering possible flood levels at Chattanooga and aids flood control of the Tennessee River. The storage capacity of the reservoir will, with very few exceptional years, control the flood waters from above the dam.

The 64,000 KVA unit fulfills the third function of the Hiwassee project by furnishing power for the Tennessee Valley Authority's electrical system. The growing demand for power in the valley may require the installation of the second unit of the same size (for which provisions have already been made to some extent in the permanent construction) some time in the near future.

Roads and Railways Relocated

The flooding of the reservoir made the reconstruction of roads and relocation of railroads necessary in the valley above the dam. Much of the work for the protection of the town of Murphy has been completed. This included adjusting the sewer and water systems, and raising and recontructing some of the bridges. Most of the reservoir area is covered with second growth timber, so comparatively only a small amount of cultivated land is destroyed, and only a few families will be removed from the area.



● Site plan of Hiwassee Dam showing general arrangement of construction works and various buildings.

The dam site being situated about 24 miles from the nearest town, a construction camp was necessary, so the Tennessee Valley Authority built a small, modern village to house its employees. Unmarried personnel or employees without families are housed in dormitories. Each of the men's dormitories provide room for 104 men, with two men to a room; the women's dormitory is smaller and contains but 16 rooms. A modern cafeteria has been built, equipped with an all electric kitchen, cold storage rooms, electrical heating and ventilating system, and a dining room with a seating capacity of 240 to furnish meals for employees and visitors. Quarters for married men and their families were built along the winding roads through the village. These comprise 3 permanent and 42 semi-permanent houses, which will later be available and used for the operating personnel, and about 90 temporary low cost houses. The semi-permanent houses have from one to three bedrooms with installed facilities for electric heating, refrigeration and cooking. The second group of houses have exterior and interior walls, and ceiling constructed of fibre wallboard and the roof of sheet metal. These houses provide attractive well-arranged and comfortable quarters with modern utilities, such as roads, sanitary water supply and sewage system, all at a very low cost which is reflected in low rents.

A community building in the center of the village houses most of the important activities. It contains a drug store, post office, a large auditorium which is used for Church and Sunday School, lectures, athletic games, dances, and moving pictures; fire station, police station, barber shop, school rooms, library and camp administrative offices. The large lounge and recreation room of the building are in continuous use by employees when not working, espe-

cially during the day time and early evening.

A camp hospital provides 17 beds for patients and quarters for some of the staff. This hospital is completely equipped for all types of medical work. Hospitalization and medical care for the families of the employees are provided for a small monthly fee. A grocery store, school, filling station, and bowling alley complete the buildings in the village. Along the access road numerous houses have been built by men unable to find a residence in the camp.

Shop facilities have been housed in a group of buildings near the dam, constructed on filled ground on the south bank of the river. Spoil from the dam excavation provided the necessary fill material. Here the carpenter shop, machine shop, warehouses, tin shop, garages, time office and storage yards are located. Domestic water is supplied to the village and all portions of the construction area. The domestic water is filtered, chlorinated, treated, and stored in an elevated tank 100 feet above the filter plant. Raw water for construction and concreting operations is pumped from the river to auxiliary tanks and distributed over the work. A central air compressor plant supplies air lines running to all parts of the job.

Access roads became a first consideration as the dam site was inaccessible, particularly for heavy equipment. Construction equipment was delivered to the nearest railhead, 18 miles away. Local highways came within four miles of the site on the north side and somewhat further on the south side. An old woods road led in from the local highway on the north side to a point about one half mile upstream from the axis of the dam. Shovels number 2 and 3, a Lorain 75 (1¼ yd. dipper) and a Lorain 75 (1½-yd. dipper) were unloaded at Murphy and after traveling a circuitous route, because these local mountain roads and bridges were built for light traffic, arrived at the woods road. The shovels made the trip in three days which was considered good time, because original grading was done on the trip on account of restricted clearances and fording some streams around weak bridges and culverts. From the highway to the site, the woods was widened to 20 feet and such improvements were made as were compatible with required construction speed. Most shovel work was sidecasting, with two Linn tractors doing what hauling was necessary. On reaching the

● Above: Veteran of many big jobs is this Bucyrus-Erie cleaning up muck after sluicing operations in the quarry. Below: Detail of cribbing supporting a Keystone drill.

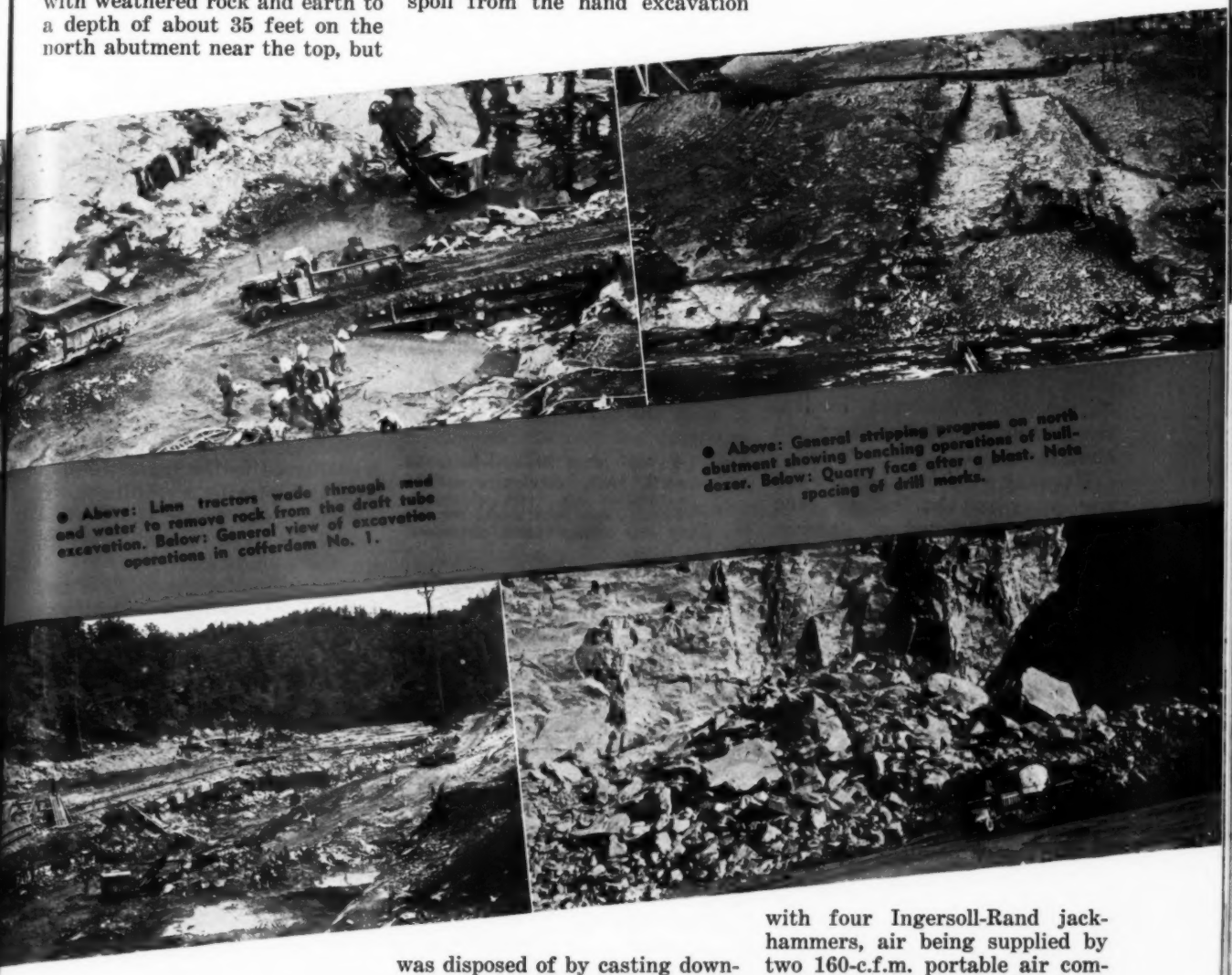
● Above: General view of quarry operations showing two Bucyrus-Eries and one Keystone drilling on quarry face. Below: A Lorain and Koehring excavate the north abutment.

site, the shovels forded the river and began work on a short road to connect with the south access road being built by private contract.

The hillsides forming the abutments rise on a steep slope from the river. Sound rock is covered with weathered rock and earth to a depth of about 35 feet on the north abutment near the top, but on the slope near the river the rock was covered with a thin deposit of earth with numerous outcroppings. On the south side the overburden was very thin until the slope immediately above the river was reached, where considerable earth and boulders covered the rock. The abutment excavations involved some 100,000 cubic yards of earth and rock. Excavation in the spillway, intake, powerhouse and tailrace sections, made behind cofferdams, involved 199,000 cubic yards of materials, chiefly rock.

Clearing for the south abutment started in November 1936, and the first excavation was carried on by hand as the overburden was so shallow it was impracticable to use a power shovel. The spoil from the hand excavation was disposed of by casting downhill. In December, shovel No. 3, the Lorain 75 with a 1½-cu. yd. dipper, was moved in and a series of switchbacks excavated a road to the top of the abutment. A bulldozer was worked in conjunction with this shovel in building the temporary road. The spoil that had accumulated from the hand stripping was overcasted and the earth and blasted rock for the foundation was removed with the shovel. When the excavation reached an elevation below the flow level of the reservoir the excavated material was wasted on the hillside above the dam. Accordingly, in January a bulldozer and Linn tractor were moved in and hauling was commenced to the spoil bank. The drilling for rock excavation was accomplished with four Ingersoll-Rand jackhammers, air being supplied by two 160-c.f.m. portable air compressors. Later, as the shovel was moved downhill a temporary road was benched out downstream from the axis; so that the excavated material was hauled to the shop area where a fill was constructed to provide additional area for shop buildings. Two 8-cu. yd. Linn tractors, two 4-cu. yd. Federal dump trucks and several 2½-cu. yd. dump trucks, rented from a private contractor, were used in hauling the excavated material to the shop area.

The graywacke rock in the



● Above: Linn tractors wade through mud and water to remove rock from the draft tube excavation. Below: General view of excavation operations in cofferdam No. 1.

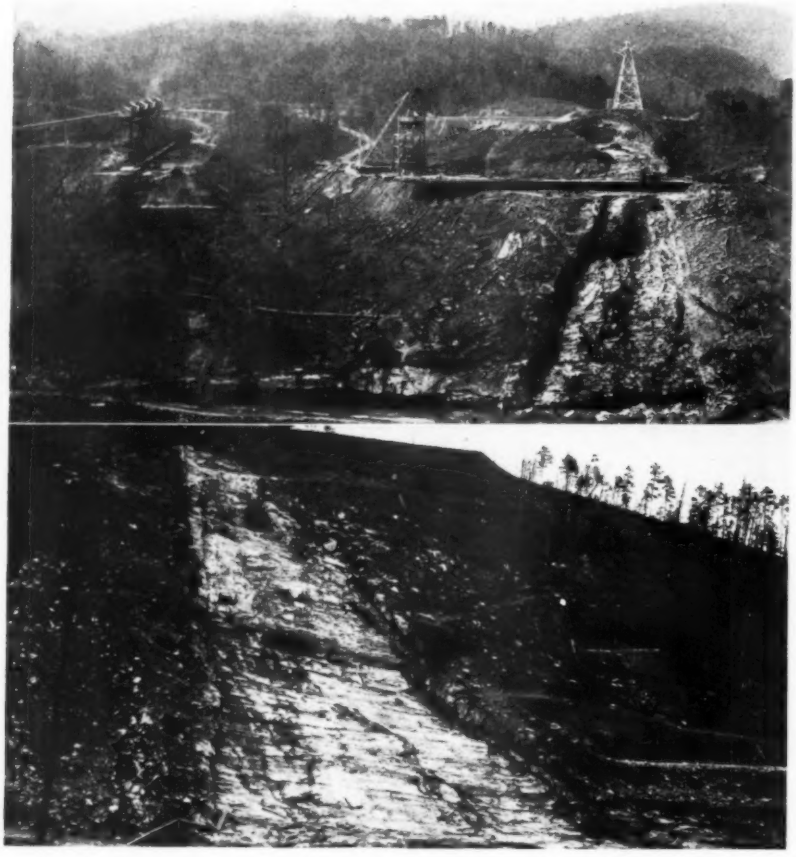
● Above: General stripping progress on north abutment showing benching operations of bulldozer. Below: Quarry face after a blast. Note spacing of drill marks.

abutment contains about 70% silica, so wet drilling was decided upon to eliminate the silcosis hazard from the dust. The jackhammers were fitted with wet heads and the water supplied by a 3-inch portable centrifugal pump from the river. In May the permanent raw water system and the central air compressor station went into operation and the subsequent use of portable pumps and air compressors was abandoned. From time to time new access ramps were constructed as required during the progress of the excavation down the hill towards the river. Occasionally after rains, mud limited the hauling units to the Linn tractors. After about six months operations, the excavation reached the river, and then continued to operate for several weeks behind temporary sand bag dikes. Coincident with the work on the south abutment, excavation was also started on the north abutment.

Here the overburden at the top was heavy and the first stripping operations consisted of sluicing. The accumulated sluiced material at the foot of the slope was loaded with a shovel. First excavation began at the point where the transfer track for distributing concrete from the mixer plant was to be located. Here work was started with the 1¼-yd. Lorain 75 shovel. Work on the north slope was interrupted for two months when the shovel was moved out to grade the yard at Turtletown, the railhead. When sluicing operations had removed all loose material, drilling and blasting for the foundation was started. The loose boulders were allowed to roll down hill and eventually built up a pile of sufficient size such that at various times the bulldozer lifted by the cableway, could be placed on top of the accumulated rock. From this vantage point the bulldozer pushed accumulated rock down to the foot of the slope where the loading of trucks was being done with the Lorain shovel. Intermittent work continued on the north slope throughout the year as equipment was available from other work. In December 1938 a large quantity of rock was moved down the hillside by rigging a 2½-yd. dragline bucket which was pulled down the slope by a Linn tractor working near the river and hoisted back up the slope with the cableway.

By March the excavation was essentially completed except for scattered drilling to roughen the surface in places and for clean-up. Grout hole drilling commenced on the abutments with two wagon drills. The 80-foot holes for the grout curtain were drilled with the diamond core drill, while the 40-foot holes were drilled with the wagon drills. The cableway was used to move the drills. Grouting of the 40-foot holes followed drilling as closely as possible. The grout was mixed in an open horizontal type of tank mixer and transported to the holes through 2-in. iron pipe by a Gardner-Denver pneumatic pump. Hand crews scaled the loose rock and cleaned up the foundation.

● Top: View of operations on north bank, showing completed excavation for north abutment. Bottom: Bare rock marks the site of the cleaned south abutment.



Excavation for the spillway and intake sections of the dam was largely in the river bed. The river bottom consisted of longitudinal ridges of bed rock strewn with heavy boulders with an occasional pocket of sand. Disconnected seams of badly weathered rock underlying the surface of the bed rock in the river channel, required the final excavation in the channel to go down as far as 55 feet below the original surface. The work was carried on in two stages; stage 1, behind cofferdam 1 on the south side of the river in the fall of 1937; and stage 2, behind cofferdam 2 on the north side of the river in the summer of 1938. The spoil was disposed of at first in the fill for the construction area, then in a spoil bank upstream from the dam.

The excavation was carried on with the Lorain 75 1½-cu. yd. shovel down from the south abutment and continued on into the cofferdam. While the cofferdam was still under construction, the excavation was being done along the bank with the shovel and as far out into the river as the depth

of the water would permit. A 1½-cu. yd. shovel, Koehring 601, also commenced excavation work in August. These shovels were worked behind the bag dikes in the cofferdam area until nearly the entire area had been excavated. The various hauling ramps were steep and slippery, so rubber-tired units had difficulty in negotiating the grades. The hauling was therefore done with four TVA Linns and four hired Linns which appeared much more suitable for the work. While working behind the sand bag dikes operations were once interrupted by a rise in the river which flooded the area. Upon completion of the cofferdam the shovels were worked steadily until November when little remained to be done except general clean-up. In January the cofferdam was allowed to fill with seepage water in preparation for the spring floods. In April, after unwatering, only the cleanup and the removal of rock fragments blown into the area from blasting across the river were required before the concreting operations could be started.

Work commenced in stage 2, cofferdam 2, with the 1¼-cu. yd. Lorain that had been used on the north abutment. In July this shovel was replaced with the new Koehring 601, mentioned above. In the late summer the shovels were used in cofferdam 2 only when no loose rock was available in cofferdam 1. In November wagon drills were moved in for the drilling which made it possible to use both shovels for the excavation until the middle of December when the Koehring was fitted with a crane boom and used in the erection of the construction plan.

Begin Spillway Pool Excavation

In May 1938 both shovels moved back to the north abutment and commenced excavation behind a dike constructed from excavated spoil. High water occasionally caused suspension of operations. Deep excavation was begun for the spillway pool and carried forward with wagon drills for the main blasting and with jackhammers for the secondary blasting. In June the Koehring was moved to the south bank of the river to

● An on-the-job idea was this buggy and winch for hauling drill bits from the drills to the resharpening shop.

commence the removal of cofferdam 1. In July shovel No. 7, a Bucyrus-Erie 75-B with a 2½-cu. yd. dipper moved into the cofferdam area from the quarry.

The Lorain shovel was used in the construction of the upstream arm of cofferdam No. 2. This shovel excavated clay for the core of the timber crib cofferdam and was used to provide the rock fill and upstream toe protection for the cofferdam. As the timber crib neared completion the shovel worked into the river and cleaned out the channel upstream from cofferdam No. 1 to permit better flow between the blocks of the dam that had been constructed in cofferdam No. 1. The Bucyrus-Erie made the heavy excavation for the spillway apron. The old main arm of cofferdam 1 as well as the rock excavation, had to be removed by the shovels. The rock was drilled with wagon drills working along the top of the cut and drilling a series of parallel faces the full length of the spillway blocks and roughly perpendicular to the dam axis. Trucking ramps were provided at the downstream end of the excavation. Three 12-cu. yd. White trucks and one 12-cu. yd. Hug truck hauled from the Bucyrus-Erie, while Linn tractors hauled spoil from the two smaller shovels. As the excavation in the spillway pool became deeper, a timber ramp was constructed to remove the material to the downstream spoil bank. As the work was progressing satisfactorily the Lorain shovel was shipped to the Kentucky Project and the Koehring and Bucyrus-Erie completed the excavation. The lighter shovel excavated the deeper trenches along the fault zones and the major excavation was carried on by the large Bucyrus-Erie. The excavation was completed in October 1938.

Complete Aggregate Plant

All aggregate for the concrete in the project was produced at the dam site. The quarry from which the aggregate is obtained is an out-cropping of graywacke with almost no overburden located on the north bank of the river about half a mile downstream from the dam. Rock from the quarry is dumped into a 42-in. gyratory McCully primary crusher located at the mouth of the quarry. A belt conveyor takes the rock to a primary storage pile. This storage pile acts as a surge pile permitting even flow of material to the secondary crusher when the primary crusher is shut down for blasting or for repairs. From this stock pile another conveyor belt carries the rock to the secondary crusher buildings. An automatic loading device fitted with a vibrator feeds the belt from the bottom of the storage pile. Little hand work is necessary although a man is stationed there to watch the belt. An electro magnet hangs directly above the belt to remove pieces of metal that might be in the material. These are bolts, pieces of drill steel, and miscellaneous scrap that have found their way into the crushed rock. This safeguard prevents serious damage to the ham-

(Continued on page 254)

FRESH WATER FO

Completion of a $4,000,000 dam and pipe line will solve the water supply problems of this Pennsylvania town.

By RALPH H. BUTZ

CULMINATING a 20 year search for an adequate source of fresh water supply for the city of Bethlehem, Pennsylvania, this year's completion of the Wild Creek Reservoir and the already completed pipe line of 24 miles from the reservoir to the city is assurance of an uninterrupted water supply for a population of 70,000 as well as the Bethlehem Steel Company's huge plants in this area.

Total expenditures for the project including construction, engineering, legal, and land will be $4,000,000, of which $1,720,000 has been allocated for dam construction; $649,000 for driving tunnels through two mountains, and $1,144,000 for pipe and excavating the 24-mile line.

Financing of the project was provided by bonds totaling 55% of the entire cost and the remaining 45% is guaranteed under Federal Work Relief grants.

The commission in charge of the project is the Bethlehem Municipal Water Authority, whose members are also members of the city council. R. L. Fox, city engineer, is the executive engineer for the Water Authority.

Reservoir Two Miles Square

Located in a natural watershed in the Pocono mountains near Kresgeville, where three small streams converge to form Wild Creek, a reservoir covering an area of about two square miles is made possible by filling in a narrow gap between two hills with about 1,500,000 cubic yards of impervious clay. Wild Creek dam will be 135 feet high and 1,200 feet long at the crest and will impound four billion gallons of water.

The project was subdivided into five contracts as follows: Contract No. 1 for the clearing and grubbing of about 300 acres of land was awarded to Depue and Beers of Bangor, Pennsylvania. Contract No. 2 for two miles of 20-inch steel pipe line was awarded to Malone and Sons of Lancaster, Pennsylvania. Contract No. 3 for the construction of the main pipe line from the dam to the city, a distance of about 24 miles was awarded to the Lock Joint Pipe Company of Ampere, New Jersey. This company, besides installing the pipe line, fabricated the pipe at a temporary plant at Danielsville, Pennsylvania. Contract No. 4, for the tunnels, was awarded to the Kaufman Construction Company of Philadelphia, Pennsylvania. Contract No. 5 for the construction of the impounding dam and appurtenances was awarded to C. W. Good Construction Company of Lancaster, Pennsylvania. A subcontract for the construction of the chemical control building and pressure control station was awarded to Stoudt Contracting Company of Bethlehem, Pennsylvania.

Excavation for the pipe line presented no unusual problems since 75 per cent of the work was done along city and county highways, and about 20 per cent through farm properties for which right of way had been arranged. In clearing a short section through the mountains near the dam site, trees and brush were chopped down for a width of about 50 feet and the ground was cleared of roots and rocks with bulldozers and scrapers.

The trench for the pipe line had vertical sides and a width about 18 inches greater than the diameter of the pipe. The shovels were used as cranes to place the pipe in position, care being taken not to damage the coating or lining of the pipe.

In working along main highways traffic interruptions were minimized by opening trenches for very short distances. Shovels excavated enough trench for several sections of pipe, placed them in position, and the trench was immediately filled in by dump trucks shuttling back and forth from the shovels.

Placing Impervious Fill

In constructing an impervious clay core breastwork for the dam to prevent seepage, a crew of five stone pickers follows a truck as it shuttles back and forth over the

● Left: An Allis-Chalmers diesel tows a battery of water-weighted tamping rollers over the fill. Right: Loading trucks at batching plant for delivery to mixers.

BETHLEHEM

dumped ground. All large stones are thrown on the truck and hauled from the site.

A battery of Euclid tamping rollers, drawn by an International diesel tractor, tamps the ground as the trucks dump it and scrapers level it.

A Northwest 2-yard shovel loads a fleet of ten International 4-ton trucks at the rate of 90 trucks an hour. A fleet of five Euclid 5-yard scraper loaders dump 250 cubic yards an hour. Two LeTourneau scraper loaders, a model F and an RU also work on the job.

Hauling roads are constantly serviced by a scraper and the resulting smooth roads allow the trucks to operate at speeds up to 25 miles an hour. A 24-hour schedule is maintained and night work is facilitated by ten batteries of floodlights which illuminate all the working sections of the project. Electric light and power is purchased from the Pennsylvania Power and Light Company.

The normal capacity of the pipe line is 18,000,000 gallons per day, while the city's present requirements total 7,000,000 gallons. No provision has been made for the installation of booster pumps because the normal flow is considered adequate for all requirements. The water flows by gravity and the reserve supply in the dam is considered ample for five months.

● **Below: Placing fill on the Wild Creek Dam. Floodlight towers at upper left mark final height of fill. Right: A Euclid Trak-Truk and scraper about to dump a 5-yard load.**

● **Putting in a section of the 24-mile reservoir pipeline with the assistance of a Northwest dragshovel. Below: Night operations were made possible by 10 of these floodlight batteries.**

In addition to the surface excavation, two tunnels of 5,800 feet and 4,700 feet each 7 feet in diameter were driven through two mountain ridges. Mucking machines were used here to a limited extent because of the continuous rock and shale formations, which necessitated extensive blasting operations. Small electrically operated dump cars were used to haul the excavations to the face of the tunnel, dumped in a pit, and brought to the surface with a Northwest 2-yard clamshell equipped shovel.

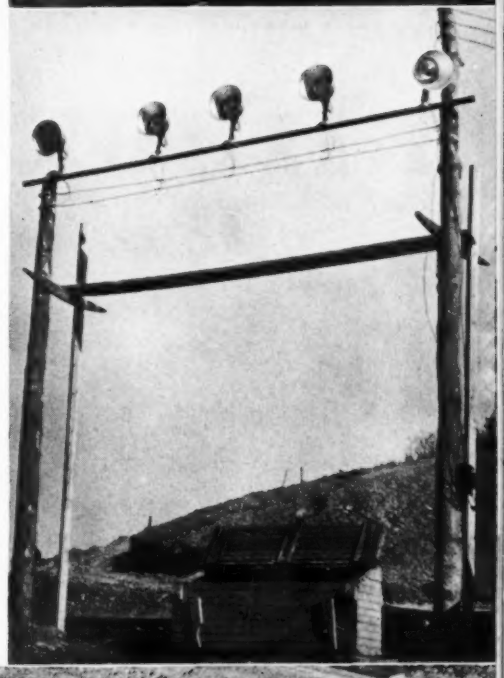
Protection from falling rocks in the tunnel was afforded by placing semi-circular steel plates as fast as the tunnel was opened.

Laying the Pipe Line

Reinforced lock-joint pressure pipe, 36 inches and 30 inches diameter, is fabricated with a thin steel core around which wire rods are welded for reinforcement and rigidity. Sheet steel is first formed into a pipe of the proper diameter and the seam is electrically welded. The joint section is then welded onto one end, after which the reinforcing rods are welded against the outside of the tube.

The completed steel tube is then placed in a metal form where a cement coating and lining is ap-

(Continued on page 238)



● A moonlit mantle of snow lends an air of mystery to night mining operations in the Kiirunavaara iron mines.

KIIRUNAVAARA IRON

● Its cab covered with wood for protection against the cold and flying rock, a 5-yard Bucyrus-Erie works in the Arctic darkness.

N

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ness.

Modern equipment and methods play an important part in working the world's finest and richest single ore deposit in the hills of Kiruna, Sweden

By G. E. SAVORY

SOME HUNDRED miles north of the Arctic Circle, in Swedish Lapland, lie the famed iron ore deposits of the Swedish company, Luossavarra Kiirunavaara Aktiebolag — more generally known as Messrs. L.K.A.B. These ore deposits, celebrated all over the world for their extent and extreme uniform richness, are one of Sweden's most important natural resources.

Kiruna, situated in the center of this natural treasure chest, has become one of the best equipped mining towns in the world. The town is located in a valley beside Lake Luossajarvi and just north of a ridge of hills called Kiirunavaara. This ridge is an almost continuous body of iron ore. To the north of the valley is another range of hills called Luossavaara which also contains large deposits of iron ore.

The town of Kiruna is about 100 miles north of the Arctic Circle and is 190 miles from Lulea and 106 miles from Narvik. A railway which has been constructed from Lulea to Narvik also passes through Kiruna.

Three Mile Ore Deposit

Rising some 250 meters (820 feet) above the level of Lake Luossajarvi, the Kiruna hills cap the top of an ore body which is of lenticular shape and about 5 kilometers (3⅛ miles) long, by some 100 meters (328 feet) average horizontal width. The great depth of this deposit has been evidenced by a test hole which was put down 800 meters (2,625 feet) below the lake level and was still in ore. So far about 100 million tons of ore have been extracted from this deposit. The dip of the Kiruna ore body is 55 to 60 degrees to the east (see accompanying sketch). Hanging walls consist of porphyry rock and the foot wall of syenite porphyry rock, with dykes of quartz porphyry some of which extend into the ore body.

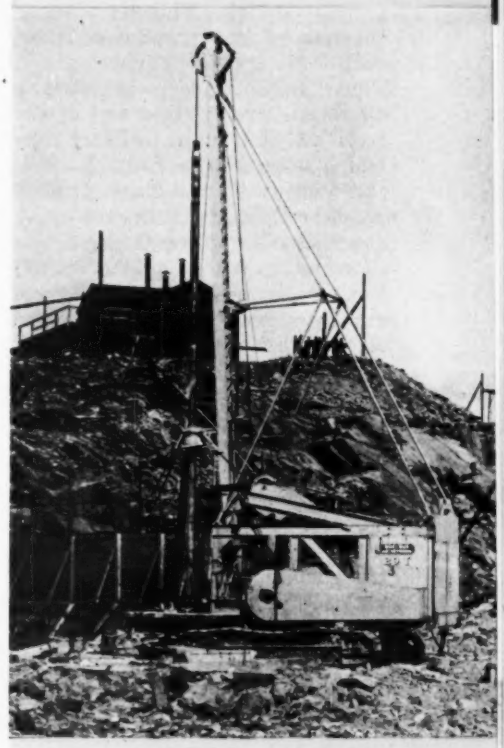
The Luossavaara ore body is 1.2 kilometers (about 1 mile) long and is 50 meters (164 feet) at the widest point. This deposit is just east-south-east at 65 to 70 degrees, and the area of the original outcrop was 37,000 square miles.

Both Kiruna and Luossavaara hold a unique position among the world's large iron ore deposits because of the unusually large quantities of ore available and because of the chemical composition of this ore. These deposits consist almost entirely of magnetite and are remarkably free from the presence of non-metallic constituents except apatite. The average iron content runs from 55 to 70 per cent, the silicates average 1 to 3 per cent, sulphur is around .05 per cent and titaniferous minerals not more than .5 per cent. Phosphorous is almost invariably present, but the actual percentage varies from a few hundredths of one per cent up to, in some cases, six per cent. The ore, however, is so uniform that if the percentage of phosphorous is known the percentage of iron can be calculated with reasonable certainty. The manner in which the apatite occurs in the ore varies; in some cases it is found as minute grains disseminated through the magnetite, in others as fine veins or crack-fillings, and in others as stratified masses up to 0.3 meters (12 inches) in width and 10 to 15 meters (32⅔ to 50 feet) in length. Weight of the ore averages 4.25 metric tons per cubic meter solid, and 2.8 tons per cubic meter broken in the cars. The waste rock weighs about 2.75 tons per cubic meter solid, and 1.75 tons per cubic meter loose.

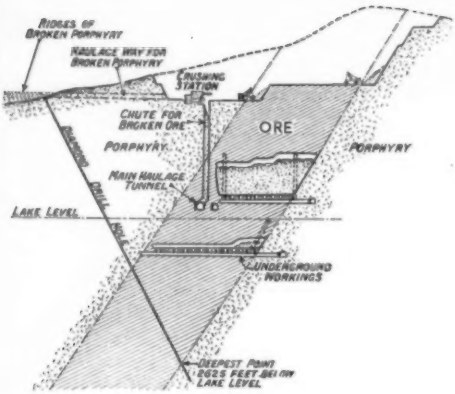
Open-Cut Operations

The largest part of the ore produced at Kiruna is recovered by quarrying methods in open-cut workings. These operations consist of blasting down the ore on three main levels where it is loaded by means of electric shovels into large quarry cars, which in turn carry the ore to the crushing plant and dump it directly to the

● Looking at the town of Kiruna from the Kiruna mines; in the distance is the Luossavaara range.



● A Bucyrus-Erie 29-T awaits the start of the next drilling shift. Below: The port of Narvik, where the ore enters the world's trade routes.



● Cross-section sketch of the Kiirunavaara ore body indicating the position of the main haulage tunnel.

crusher. Here the broken ore passes down chutes to pockets for storage. These pockets discharge their content into ore cars in a main tunnel which runs the entire length of the ore body (see accompanying sketch). This main tunnel consists of two parallel sections, each 5 meters (16½ feet) square. These tunnels, each carrying a single rail track, come out at the level of the main railway line which runs across Lake Luossajarvi on an enbankment. Broken porphyry is loaded into cars which are drawn out through these tunnels and deposited on the side of the mountain. In this way great dumps of rock have been formed on the northeast slope of Kiirunavaara, each ridge being about 15 meters (50 feet) lower than the other. The accompanying cross section shows the operating policy of stripping back the porphyry for quite a considerable distance from the ore body. This is done because it is considered desirable to have the porphyry in the hanging wall make an angle of about 65 degrees from what will eventually be the lowest open cut level in the ore body, that is, the lake level.

To remove the porphyry overburden, vertical holes are drilled from the top of the bench and horizontal holes at the lower level. Drilling operations are performed jointly by Ingersoll-Rand wagon drills and by electrically-driven Bucyrus-Erie 29-T caterpillar-mounted blast hole drills. Vertical holes are 9 inches in diameter and vary from 17 to 32 meters (56½ to 104½ feet) in depth.

Servicing Drill Bits

Drill bits are serviced by a Bucyrus-Erie No. 12 bit dresser, which is located in a special bit dressing house in the open cut pit. Two men operate the dresser, along with an oil burning bit furnace capable of holding four 9-inch bits. One oil burning tempering furnace with a capacity of two 9-inch bits and one bit quenching tank with a tilting rack for 4 bits completes this equipment. The bits are handled from operation to operation by a double jib self-supporting type bit crane. One set of fishing tools is available for these four drills.

The rock overburden of fine and close grained porphyry makes drilling operations quite difficult. Drilling is further complicated by seams in this porphyry which will snap drill bits off unless precautions are taken. These seams are usually overcome by firing a small amount of dynamite just at the level of the seams to soften or burn the rock and thus avoid deflection of the drill bit.

Because of the abrasive quality of the rock it is necesasry to resharpen the drill bits on an average of every 1½ meters (5 feet) of hole drilled. The holes are spaced about 5 to 9 meters (16½ to 29½ feet) apart and 12 meters (39¼ feet) back from the toe of the face and at a depth, as previously mentioned, ranging from 17 to 32 meters (56½ to 104½ feet). Taking into account the slope of the overburden face, the holes are actually about 7 meters (23 feet) back from the top of the face.

Working with a stroke of 38 inches at ground level, the Bucyrus-Erie 29-T drills average about 50 strokes per minute, with a drilling speed from 3 to 6 meters (19¾ to 19½ feet) per 7½ hour shift. The life of the drill cable is about 700 to 800 meters (2,296 to 2,625 feet) of holes drilled.

So far these drills have only been used in the overburden, but later Messrs. L.K.A.B. plan to use them in the ore deposit as well.

At present the ore is drilled with Ingersoll-Rand wagon drills. Holes are started at 3 inches diameter and drilled 7½ meters (24½ feet) deep, finishing at a diameter of 2⅝ inches. It is necessary to spring these holes several times to get a sufficiently large chamber to take the required amount of explosive. The ore is drilled both vertically and horizontally; the horizontal holes, being slightly inclined to keep out the water, are put in 7 meters (23 feet) deep at the toe of the face. As many as 300 holes, containing about 15 tons of dynamite, are shot simultaneously. About 4 tons of material are moved per pound of explosive.

Loading Operations

Loading operations at Kiruna are handled by a large number of electric shovels which handle blasted overburden as well as

● Two wagon drills at work on the ore body present a decided contrast in age.

blasted ore. Heading the L.K.A.B. shovel line-up are the Ward Leonard controlled 4 and 5 cubic yard Bucyrus-Erie shovels. The balance, which are of Swedish and German make, are Menck, Hambrock, and Morgardshammer machines. Current for the shovels is 25 cycles 3 phase, 2,100 volts.

In the early days of mechanical loading there were a number of half-revolving Bucyrus-Erie railroad type shovels in use, but these have all been superseded by the more modern revolving type, and the old shovels are now relegated to work in the stockpiles at the loading ports. In recent years Messrs. L.K.A.B. have standardized on the 5 cubic yard Bucyrus-Erie 170-B type shovel as being the most economical and the best suited to the rugged and heavy digging involved. Seven of these machines are at work at the present time and two further installations are planned.

In all, about 16 shovels are at work in the open cut, and in a typical year each machine averages about 570 shifts of 7½ hours. The 120-B five cubic yard shovels average an output of about 1,500 tons per shift in overburden and 2,000 tons per shift in the ore.

By careful organization Messrs. L.K.A.B. have achieved very low expenditures for spare parts and repairs on the shovels. Constantly wearing items, such as hoist ropes and dipper teeth, in spite of the extremely heavy nature of the work, and the abrasive nature of the material, give good service. For instance, the hoist ropes have a life of from 200,000 to 300,000 tons, and dipper teeth, which are of manganese steel and of a special shape patented by Messrs. L.K.A.B., give excellent results as the use of 600 teeth in handling ten million tons of material prove.

There is no doubt that the extreme flexibility given by the Ward-Leonard system of control accounts in a large measure for the economy of operation of the electric shovels. The latest type 170-B shovels are equipped with what are termed "master controllers." Instead of the hand controllers with which the operator usually drives the machine carrying the field current of the generators, these machines only carry light current sufficient to operate magnetic contactors which in turn take care of the variable voltage or field control which is the basic principle of the Ward-Leonard system. There are no brakes or clutches which the operator has to employ when digging, all motions being entirely controlled by the small master controllers, one for the hoist, one for the dipper thrust, and one for the swing, the dipper always being connected to its driving motors. Fast action swing is made possible by twin swing motors.

● Winter view of the stripping operations at Kiruna, showing the electrified track for ore trains.

Operations are so organized that in general only two 7½ hour shifts are worked per day by the shovels. Messrs. L.K.A.B. have found from long experience that this is the most efficient method for their particular type of operation.

Underground Mining Activity

Owing to the demand for the high grade "A" ore the company has also found it profitable to carry on underground mining operations. Shafts have been sunk to a depth of 50 meters (164 feet) below the adjoining lake level. These operations have indicated that the amount of grade "A" ore in the deposit increases with increasing depth. This grade is the only ore that has been removed in the underground operations. The shack for hoisting ore is situated about 1,000 meters (3,280 feet) from the north end of the main tunnel mentioned previously. Main drifts are driven in the footwall at some distance from the ore body and may accommodate two or three sets of rails, the width being 4½ and 6 meters (14½ to 19½ feet) respectively, and the height 3 meters (9½ feet). Cross-cuts 2½ by 2½ meters (8 1/6 by 8 1/6 feet), are driven from the footwall through to the hanging wall and ore chutes are cut along one side of the cross-cut at intervals of 6½ meters (20⅓ feet). These chutes are built up in concrete, the sides and gate being made of steel.

In opening up a stope, a rise is driven up through a pillar to the level above and then, at a height of 5½ meters (18 feet) above the floor of the cross-cut, a tunnel is driven through horizontally to make connection between the chutes. The tops of the chutes are opened out in a funnel shape and then slices 5 meters (16½ feet) are taken out horizontally. All underground mining is by shrinkage stoping and the stopes are 10 meters (32⅔ feet) wide with a 2 meter (8 1/6 foot) pillar between each. Blocks of 6 to 8 stopes are made in a 12 meter (39¼ foot) pillar left between each block.

Atlas machines type MAV 50 and RWT 72 are used for drilling in the stopes, with machines of

(*Continued on page 238*)

EXCAVATING ENGINEER

A Monthly Publication

Devoted to the Excavating Industry

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Blasting Cap Dangers

Each year there are numbers of children, under the age sixteen, who are injured, and in some instances, killed, from playing with blasting caps.

These accidents have been a matter of great concern to companies manufacturing commercial explosives, and for many years numbers of these companies carried on campaigns of warning against such accidents.

In 1926 the Institute of Makers of Explosives, a trade association comprising manufacturers of commercial explosives, took the matter up and began a vigorous movement to arouse public sentiment in the hope that parents, teachers, and all others who had children in their care, would cooperate in safeguarding boys and girls by instructing them concerning the dangers of playing with blasting caps.

Warnings against allowing these blasting caps to fall into the hands of children had for years been given to all purchasers of such blasting accessories. Increased efforts along this line were made in 1926, and new literature placed in each box of caps, together with the wording on the boxes containing the caps, specifically called attention to the dangers. These efforts have been continued each year.

Reports show that the most common types of accidents are from striking the caps with a hammer or stone. Any blasting cap will explode if it is hit hard enough with such instruments. Accidents are caused in large measure also by holding lighted matches to the caps. Picking out the explosive with a pin or nail causes many injuries.

These detonators get into the hands of children, through the carelessness of users. Workmen leave them around following blasting operations. Sometimes they are carried home by workers and left about where children can find them.

The movement to prevent accidents to children from playing with blasting caps is a worth while attempt to completely avoid such accidents and save boys and girls for useful work in later life, and we hope that these words will inspire the reader to do his bit towards making the safety campaign complete.

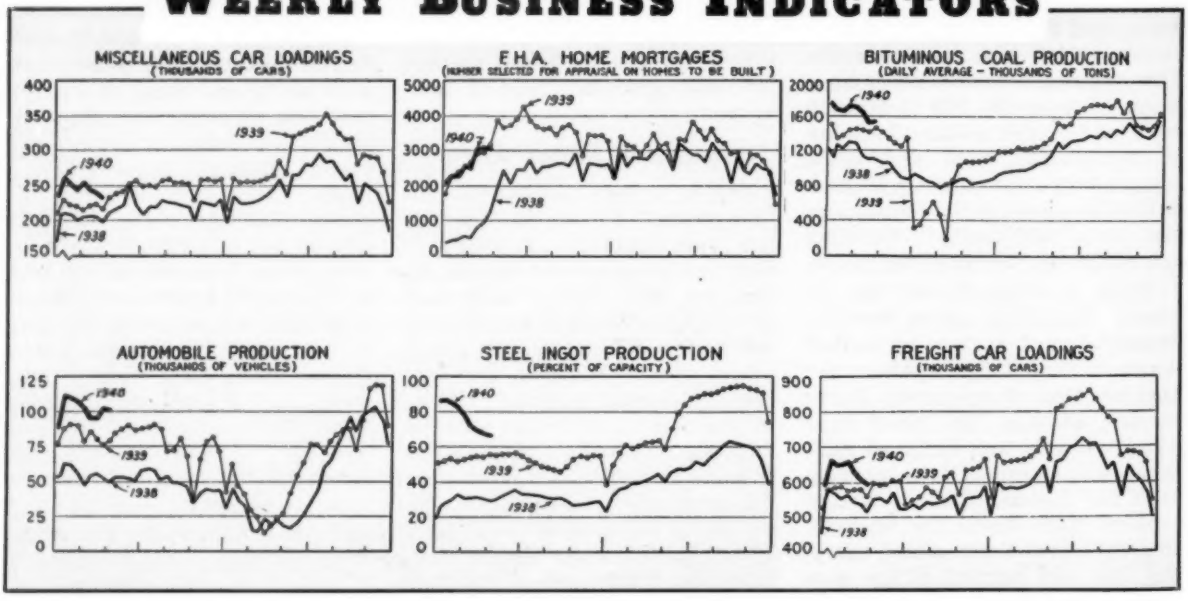
February Contracts Rise

Contracts awarded in the 37 eastern states for non-residential building for private ownership during February aggregated $43,674,000, according to the F. W. Dodge Corporation. This represented an increase of $16,218,000, or 59 per cent over February of last year and was more than enough to offset the decline, $15,197,000, registered by public non-residential projects, a reduction caused mainly by the marked reduction in the public school program.

While the valuation of contracts awarded in February for total residential building was about five per cent lower than last year, it is of considerable importance that one- and two-family houses, both for owner's occupancy and for sale or rent, not only exceeded the corresponding month 1939 but also showed improvement over the preceding month, January 1940.

The composite of total value of contracts awarded in February, for buildings, utilities and public works for private ownership, is up nine per cent over the corresponding month last year and is up 15 per cent over January 1940, while total construction for public ownership in the month is down from both periods. The net result is that total construction contracts awarded for both private and public ownership amounted to $200,574,000 in February 1940 as compared with $220,197,000 in February of last year and $196,191,000 in January of this year.

WEEKLY BUSINESS INDICATORS



A.G.C.A. STATES HIGHWAY CONTRACTORS' POSITION

H. B. ZACHRY, of Laredo, Texas, president of the Associated General Contractors of America, recently told the House Roads Committee that highway contractors can create the same number of man hours of employment and approximately twice the mileage of comparative types of highway with the same amount of money that the Work Projects Administration can.

Mr. Zachry further proposed that a substantial part of funds to be appropriated for the Work Projects Administration be appropriated for use of the Public Roads Administration for highways to be constructed under the contract system.

The text of his statement before the House Committee on Roads on the bill to assist states in improvement of highways follows:

"I come before you as president of The Associated General Contractors of America to speak particularly for that group specializing in highway construction. I, personally, belong to that group.

"I am not here pleading for an appropriation to maintain our existence as contractors, or for the support of our families and those of our workers. I am not here claiming that our government owes us a living, or that it should incur an increased debt to benefit our particular group.

"I am here to report to you that we highway contractors do justify and can further justify our existence as an industry on strictly economic grounds; that we fill and can better fill an important place in our nation.

"We know that for every thousand dollars appropriated to the Public Roads Administration, after being matched by the states in the amount required, approximately two men have been employed for one year; that when you reduce that appropriation one hundred million dollars, you have put 200,000 men out of a job. And, likewise, when you increase it a hundred million dollars, you have created jobs for 200,000 men. We believe your good judgment will show you what the appropriation should be.

"The records reveal that, during the fiscal year 1939, eight hundred and eighty one million dollars of federal funds were spent on highways, roads and streets by W.P.A.; that sponsors' funds in the amount of two hundred and twenty-three million dollars were required to match it. We know an appropriation will be made this year. We ask that a substantial part be taken from it and be placed through the Public Roads Administration to the states, then through their highway departments, and all to be handled by the contract system under the same employment regulations as apply under the present Federal Aid Act.

"We will produce with any sum thus transferred from W.P.A., the same number of man hours of employment to labor. We will give you approximately twice the mileage of comparative type highways. We will contribute 3% tax on our pay rolls to Social Security, 2% to Old Age Pensions, and an undetermined amount to Income Tax. We will pay compensation and public liability insurance, approximately 10% of labor pay roll. We will pay property tax, corporate tax, and many other taxes.

"Then think what you have when you create these additional miles of highways. . . . Think of the new cars that will be purchased for these additional miles, the new service stations and garages to care for extra travel to the new tourist camps and recreational grounds. **Every dollar spent on highways, built under the contract system, will stimulate trade to the extent of $3.15.** That is, for every one hundred million dollars so placed, trade will be stimulated an additional $315,000,000. This is the kind of business that builds the United States. . . .

"We again reiterate that any plan contemplating caring for the unemployed by creating unemployment in any existing industry is not any part of a sound economy."

E. I. Crook

THE great host of his friends throughout the West will be grieved to learn of the death, on February 13, of E. I. "Dad" Crook, in Los Angeles. A cold, contracted at the recent A.R.B.A. Road Show in Chicago, resulted in pneumonia upon his return home. He was ill less than a week.

To every one he was "Dad" Crook—even many of his intimate friends did not know his initials. With his son, W. D. "Bud" Crook, he was identified from the very start with the development of tractors and their application to construction and agriculture, and for the past twelve years had been co-partner with his son of the Crook Company, of Los Angeles, California.

"Dad" Crook was born on September, 19, 1872, at Cerro Gordo, Illinois, and his earlier years were spent in the railroad business. The lure of the West soon pulled him away from Illinois, and there he became one of the first men in the country to interest himself in the application of irrigation to large-scale farming.

His first western association was in Colorado, with Great Western Sugar Company, where he developed many of the irrigation methods in use today. Later, he became chief agriculturist for Holly Sugar Company, also in Colorado, where he made still further advances in the technique of irrigation.

From Colorado, he was called by the Alameda and Union Sugar Company to develop their lands in the Sacramento and San Joaquin Valleys of California. For a number of years "Dad" made his headquarters at Meridan and Woodland, in charge of the development of irrigation for thousands of acres of land for the growing of sugar beets. Much of this same land will now be guaranteed a permanent supply of regulated water through the Central Valley Project.

The development of tractors had just started when "Dad" Crook came to California; and he was among the first to use tractors in preparing land for irrigation farming. Thus was formed his intimate friendship with C. L. Best, whose tractor business was then in its early stages. In 1914, Mr. Best persuaded "Dad" Crook to undertake the selling of Best tractors in Southern California, where Imperial Valley was then being developed extensively. This was the start of his active association with the tractor business in which he took an intensive interest to the time of his death.

In 1925, the Best and Holt interests were consolidated to form the Caterpillar Tractor Company; and at that time Shepherd-Crook Company was established, to handle Caterpillar products in Southern California. Willard Shepherd, prior to this time, had been the distributor of Holt tractors. Then in 1928, the two interests were separated, and "Dad" Crook, with his son, Bud formed the Crook Company, taking the selling agency for Southern California for Allis-Chalmers tractors. Crook Company is now one of the four largest equipment houses in Southern California.

It was always difficult to characterize "Dad" Crook. He possessed a rugged individuality that made him one of the truly colorful men of his time; he had the courage of his convictions, and made a sharp, working distinction between right and wrong. His sound business judgment not only resulted in success in his personal affairs, but caused his counsel to be sought in both industry and agriculture. To those who knew and loved him, he was above all else, a very real and very true friend whose passing will leave a void that cannot soon be filled.

(Obituaries continued on page 252)

Equipment you ought to KNOW ABOUT

New Four-Wheel B-E Scraper

A new line of four-wheel scrapers, in a complete range of sizes matched to the new line of International TracTracTors, has just been introduced by Bucyrus-Erie Company. These scrapers have only five main parts, consisting of: (1) tongue assembly, (2) frame with side-plates, (3) apron, (4) tilting bowl, and (5) rear axle assembly.

Using two-line cable control—one cable to regulate height of the digging edge, and the other to control the opening of the apron and the tilting of the bowl—these scrapers, according to the manufacturer, give you accurate depth of both digging and spread. In dumping, the bowl is tilted upward, to an almost vertical position, giving positive, controlled, rolling ejection. The tilting bowl is a simple reinforced plate curved below and behind the dirt. It rotates between the fixed side plates of the frame. The front edge of the tilting bowl is hinged to the frame, just behind the digging blade, by means of a full-length solid bar. As it rotates about this hinge in dumping, the bottom of the bowl lifts, thus ejecting the dirt with a rolling motion. Since this ejection has the aid of gravity, minimum power is required to accomplish clean positive dumping. Adhesion of material is virtually eliminated by the sharp angle to which the bottom of the bowl is lifted and by its scraping action against the side plates of the frame. These fixed side plates close the gap at the sides between bowl and apron at all times, thus helping to prevent side spilling of dirt.

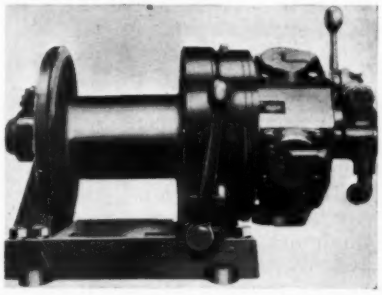
The manufacturer claims that the boiling action produced by the exclusive Bucyrus-Erie double-curved blade reduces to a minimum the tractor horsepower required for loading, and materially increases speed and ease of loading.

Stability for digging, dumping, finishing on side slopes is provided by wide wheel spread and low center of gravity. Rope life is increased by keeping the cable free of twisting bends, passing it over a minimum number of large roller - bearing interchangeable sheaves, which are all set in a single vertical plane along the center line of the scraper. Hauling of the loaded scraper is made easy by the constant wheelbase, which maintains even distribution of load. Time is saved on every trip because it is easy and safe to make short non-stop turns.

For a complete explanation of all the advantages offered in this new line of scrapers, write to this magazine or to Bucyrus-Erie Company, South Milwaukee, Wis.

Radial Air Motor Hoist

"Smoother torque than a straight 8" is what Gardner-Denver officials say about the five cylinder radial air motor used to



power their new line of single and double drum air hoists. The overlap of power impulses of this motor exceeds that of a modern 8 cylinder automobile engine, according to the manufacturer's announcement. Company engineers report that at low speeds, when the flywheel action is negligible, its smooth action is particularly noticeable. Although the motor is new in use on air hoists, it has been proved in use on Gardner-Denver mine car loaders. According to the manufacturer, the new hoists have smaller overall dimensions and less weight per horsepower delivered than any other hoists of their type. They are adapted to hoisting, hauling, dragging or scraping in mines, smelters, quarries, highway and construction work, bridge erection and in machine shops, sawmills, oil fields and refineries, gas and electric plants, shipping and industrial work.

Further information can be obtained by writing the Gardner-Denver Company, Quincy, Illinois, for Bulletin H-1.

New Novo Generator

A new line of generating sets has just been announced to the constructing and building trade by the Novo Engine Company, Lansing, Michigan. There are fifteen different sizes built in DC and AC sets, powered with air and water-cooled gasoline engines or diesel power units.

Features of these sets, accord-

ing to the manufacturer, are their close-coupled design, portability, and their switch panel which has no open switches or fuses to burn out.

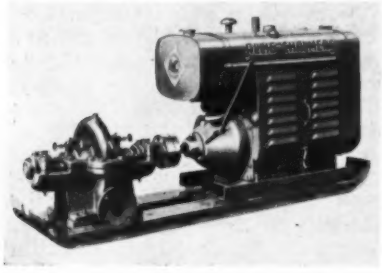
These units were built to meet the demand for light for emergency work and also for power for the myriad of electric portable tools now being used on construction jobs.

A new bulletin on these sets has been issued and is available for distribution. Copies can be obtained by writing to Novo Engine Company, Lansing, Michigan.

Centrifugal Pumps

To provide independently powered pumps for drainage, irrigation, gravel and coal washing plants, construction jobs, and similar applications, the Allis-Chalmers Mfg. Company, Milwaukee, Wisconsin, has introduced a line of centrifugal pumps driven by gasoline power units. Since these units are entirely independent of any outside source of power, municipal and private water suppliers use them as standby units in emergencies when other sources of power fail.

Power units in five sizes (18 to



110 H.P.) assure economy in operation with a choice of fuels: gasoline, kerosene, distillate, natural gas, or butane. All power units have valve-in-head medium speed engines, with removable cylinder liners, efficient cooling systems, force feed lubrication and a variable speed governor.

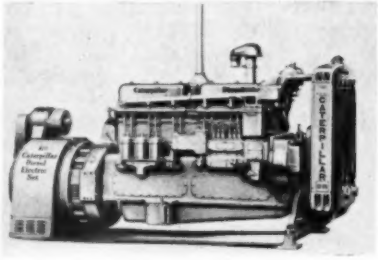
The centrifugal pumps are horizontal shaft, single stage, single or double suction pumps designed for handling liquids at normal temperatures with maximum efficiency. To facilitate handling, the engines and pumps are mounted on a base and are available in many combinations to meet various requirements in quantity and pressure up to 5000 gallons per minute and 100 foot head.

A folder (Form MS 253) describing these engine and pump units may be obtained from the Tractor Division, Allis-Chalmers Mfg. Company, Milwaukee, Wisconsin.

Caterpillar Diesel

To answer a continuing demand for larger self-contained "Caterpillar" diesel electric sets, Caterpillar Tractor Company has added a 66-kilowatt and a 52-kilowatt unit to its line.

The two new sets, the 11-52 and the 13-66, are completely self con-



tained, and require no gadgets other than a circuit breaker. Both are powered by six-cylinder, heavy-duty diesel engines; and both require a minimum of maintenance and adjustments, it is claimed. As with the smaller sets, they can be set up and running within an hour after delivery.

There are now five models of these units available in 15, 20, 30, 52 and 66 kilowatt capacities.

New Portable Electric Hammer

The Thor-Nado, an electric hammer featuring the radically new "Sling-Shot Drive" that delivers a blow unparalleled for power in a tool of its size and capacity, according to the manufacturer, is the latest product of

the Independent Pneumatic Tool Company, 600 West Jackson Blvd., Chicago, Illinois.

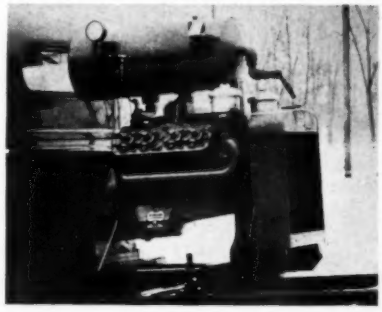
Although it measures only 13½ inches long and weighs but 14 pounds, the new hammer is adapted to a wide variety of heavy duty applications, including star drilling, channeling, chipping, cleaning, scaling, cutting, gouging, beading, caulking, and seaming. Its capacity in concrete, limestone, and brick is one inch.

Outstanding feature of the new Thor-Nado is the patented "Sling-Shot Drive," a method of driving the piston in a hammer action by means of a shock-proof rubber connection. This sling-shot drive whips the piston back and forth at a speed of 1600 blows per minute, acting as both power accumulator and shock-absorber. There is no metal connection between the piston and the gear train and motor. The blow of the piston is not felt by the operator nor is it transmitted to the gear or motor.

For further information on this tool, write to Independent Pneumatic Tool Company, 600 West Jackson Blvd., Chicago, Illinois, for Circular No. E-32.

Schramm Compressor

Schramm, Inc., West Chester, Pennsylvania, announces its newest Schramm Fordair power take-off compressor. With improved



governor controls, power take-off controls and compressor mountings, the new compressor is designated as Model 105 Fordair unit.

The compressor unit is an eight cylinder "V" block with special cylinder heads, camshaft, and manifolds. Because most of the parts are standard Ford parts, every Ford dealer can provide parts and service on this unit at prices much lower than possible with any other compressor, it is claimed.

Although this unit makes an ideal combination with a Ford truck, it will operate on any standard truck that can be provided with a split shaft power take-off. Schramm also build a compressor

"1-2-3" principle of . . . STRIPPING ECONOMY

1 To *mechanical* Bulldozer digging . . . high, powerful lift, low drop, that takes trees, stumps and rock to a cleaning . . . LeTourneau has added . . .

2 . . . dynamite on wheels with a Rooter! . . . for better fragmentation than blasting . . . at but *one-third* the cost, in a fraction of the time . . .

3 . . . for a wider Carryall Scraper range of materials than ever before. Combined, they produce the lowest rate of stripping per equipment investment that the industry has to offer.

Ask your LeTourneau and "Caterpillar" dealer to demonstrate! R. G. LeTOURNEAU, INC., *Peoria, Ill., Stockton, Calif. Cable address:* "Bobletorno".

CARRYALL* SCRAPERS, ANGLEDOZERS*, BULLDOZERS, ROOTERS*, POWER CONTROL UNITS, DRAG SCRAPERS, PUSHDOZERS, SHEEP'S FOOT ROLLERS, CRANES, TREEDOZERS.

*Name Reg. U. S. Pat. Off.

LETOURNEAU

Stripping EQUIPMENT

designed for other sizes and for other truck dealers and manufacturers.

The unit is supplied either for mounting by the customer, a local dealer, the power take-off manufacturer, or Schramm, Inc. Automatic controls are included with the unit. For further information write to Schramm, Inc., West Chester, Pennsylvania.

1940 Mack Truck Models

Seventy-five regular models are now in production by Mack

Trucks, Inc., for the year 1940. With models rated from 8500 to 100,000 pounds gross vehicle weight, Mack is now offering a selection of truck equipment including diesel and gasoline powered, conventional and cab-over-engine type, four and six-wheeler, shaft and chain driven.

Beside the forty gasoline-powered Mack truck models now in production, conventional and cab-over-engine inclusive, the company offers a full line of diesel-powered trucks equipped with engines ranging from 212 to 519 cubic inches, with wide selections also offered in diesel-powered cab-over-engine models.

In addition to its full line of trucks and tractors Mack also produces two standard semi-trailer models of lighter capacity and lower price than heretofore included in the regular Mack line. These semi-trailers feature Mack co-incidental safety lock. By means of this device the act of raising and lowering the support wheels automatically engages and disengages the parking brake. It also actuates a secondary lock on the fifth wheel which the manufacturer claims prevents nose dives, dragging brakes, and run-away trailers.

For further information please write Mack Trucks Inc., Long Island City, N. Y., mentioning Excavating Engineer.

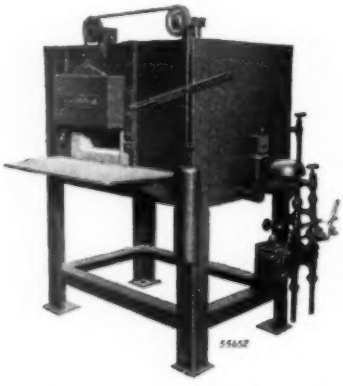
Jackfurnace

Ingersoll-Rand announces the new "Jackfurnace" for the rapid heating of their detachable rock drill bits known as "Jackbits." Designed especially for the servicing of Jackbits, it can be used with either Jackmills (hotmills) or Grinders. It can also be used for heating shanks and rod ends for hardening.

Low pressure air from an induction blower passes through a pre-heating chamber before entering the burner, thereby aiding combustion and increasing efficiency. Convenient controls enable the operator to attain the proper mixture of oil and air. The furnace can be equipped with an automatic temperature control device.

When heating Jackbits for rehardening, the Jackfurnace will handle approximately 180 Jackbits per hour, according to the manufacturer.

It is insulated to insure low room temperature for the oper-



ator. The manufacturer furnishes, as standard equipment, a loading spoon and an unloading device to facilitate the handling of Jackbits to and from the furnace.

Copies of the description sheets, Form 2609, are available from Ingersoll-Rand Company, 11 Broadway, New York, or any of their branch offices.

Over-Lubrication Preventive

Stewart-Warner Corporation, Chicago, Illinois, report that their engineers have perfected a new line of fittings and bushings that will prevent over-lubrication of ball and roller bearings on industrial machinery. The Alemite Lubriguard, as these fittings are called, are so constructed that they signal the operator when a bearing is sufficiently lubricated.

In making it impossible to cram anti-friction bearings with grease, Alemite Lubriguards save the power loss, accelerated wear, repairs, and lubricant wastage that are direct consequences of over-lubrication, it is claimed.

Intercommunication on Construction Work

Contractors and engineers will, according to the manufacturer, find a recently announced battery-operated portable Twinphone in-

tercommunication systems a great time saver and efficient aid on all kinds of construction work where electrical current is unavailable. Since the master station operates on its own power, it can be carried anywhere on the job to give instant two-way contact with the office or any other part of the construction.

This Twinphone master station can be used with one or more substations, which may be either high-powered trumpet types or regulation office models. Calls may be originated at both master and substations. Twinphone transmission is so sensitive that a foreman or workman can both hear and answer a question addressed to him from the nearby substation without putting down his tools or leaving his work, it is claimed.

The portable Twinphone master station, Model 402M, complete with three Eveready batteries, sells for $33.85. The substations are priced from $10 up, depending on the type. Address all inquiries on Twinphone Intercommunication Systems to Executone, Inc., 415 Lexington Avenue, New York City, New York.

Order from Your Nearest Distributor as Listed Below:

IN THE UNITED STATES

RPM DELO:
The California Company (Montana only)
Humble Oil & Refining Company
Standard Oil Company (Indiana)
Standard Oil Company (Nebraska)
Standard Oil Company of California
Standard Oil Company of Texas
Utah Oil Refining Company

Diol RPM DELO:
The Carter Oil Company, Tulsa, Oklahoma
Colonial Beacon Oil Company
Standard Oil Company of Louisiana
Standard Oil Company of New Jersey
Standard Oil Company of Pennsylvania

Kyso RPM DELO:
Standard Oil Company (Inc. in Kentucky)

Signal RPM DELO:
Signal Oil Company

Sohio RPM DELO:
The Standard Oil Company (Ohio)

IN CANADA & NEWFOUNDLAND

Imperial RPM DELO:
Imperial Oil Limited

IN BRITISH COLUMBIA & ALBERTA

RPM DELO:
Standard Oil Company of British Columbia Limited

THROUGHOUT THE WORLD

RPM DELO is available through distributors in more than 100 countries.

It takes a thoroughbred engine and a stubborn, pigheaded, stay-in-there-and-pitch lubricating oil to defy old man "Wear Rate". But that's just what happened when New RPM DELO teamed up with a Hamilton Diesel in recent "exhaustive tests"!

After running at full load and full speed all the way, the test engine showed *wear so slight it was "hardly measurable"*. Good reasons why!—

Every ring was free—all oil rings unclogged. That alone prevented loss of power, high oil consumption, blow-by, piston and cylinder wear.

All bearings were free from corrosion—and bearing wear was stopped cold.

Carbon formation was exceptionally low—and *no* hard carbon. Not a sign of scratching or scoring on pistons, rings, liners, etc.

Filter clogging?—Absolutely none—in hundreds of full-load hours!

General Machinery Corporation finds this test "extraordinarily satisfactory". Prove New RPM DELO's cost-cutting, money-making performance for yourself—in any make or type of Diesel. You're passing up extra operating profits every day you don't!

RPM
REG. TRADE MARK
DIESEL ENGINE LUBRICATING OIL

New "RPM" Diesel Engine Lubricating Oil available everywhere in the gray barrel with the blue head

STANDARD OIL COMPANY OF CALIFORNIA

For your convenience in writing to Standard Oil Company of California, you will find a card bound in this issue.

NOT in the *Contract*

"I hear you and the leading lady are on the outs."

Electrician: "Yeah, it was one of those quick change scenes with the stage all dark. She asked for her tights and I thought she said lights."

"Where in h--l are we," asked the drunk, leaning over the steering wheel.

"We're comin' into a town and you better slow down," answered his pal.

"Oh yeah, how c'n ya tell?"

"'Cause we're hittin' more people," came the reply.

"Did that course in English help your boy friend any?"

"No, he still ends every sentence with a proposition."

Housewife: "Will you have a cup of tea, or a glass of beer?"

Window-cleaner: "Beer's better ma'am. I find it gives a better polish when I breathe on the glass."

Socialism: You have two cows; you give one to your neighbor.

Communism: You have two cows; you give both to the government and the government gives you the milk.

Fascism: You keep the cows, give the milk to the government, and the government sells it back to you.

Naziism: The government takes you and takes the cows.

New Dealism: The government shoots one of the cows, milks the other one, and pours the milk down the sewer.

Capitalism: You sell one cow and buy a bull.

"Marry my daughter! Ha! Young man, you couldn't keep her in underwear."

"Well, you haven't been doing so well at times yourself, pop."

"Lady, there's no red light on your car."

"No, sir, it's not that kind of car."

"Shine, Mister?"

Never Too Old

A doctor had a diabetic patient, an elderly lady, a grandmother, in fact. She was put on a strict diet, but would not play the game and was "cheating" all the while. After every violation, she got into trouble and the doctor was sent for. He got weary of these constant calls and said she had to go to a certain hospital where he could control the food and prevent violations of rules. Owing to its crowded condition, the only available room at this hospital was in the maternity ward . . . where the old lady was installed.

After she had been there two or three days, her 7 year old granddaughter paid her a visit and was lolling in front of the door to grandmother's room when some visitors came along.

"What are you doing here, little girl?"

"I'm here visiting grandmother."

"Grandmother!" said one of the visitors in astonishment. "What is she doing here?"

"Oh," said the youngster, "She's been cheating again."

"Rastus, did your father go to the lodge meeting last night?"

"Naw, sir! We had to postpone it."

"Postpone it? Why?"

"Why? Because de Grand All-Powerful, Invincible, Most Supreme, Unconquerable Potentate done got beat up by his wife."

Little Tommy was asked the difference between prose and poetry. He pondered awhile and then said, "There was a young lady named Bass who went into the sea to her ankles."

"That's prose," he explained, "but if the water had been a little deeper, it would have been poetry."

First Little Bird: "Hoo's that sittin' on the park bench below us?"

Second Little Bird: "That's the guy who fired buckshot at us the other day."

Third Little Bird: "Well, wot are we waitin' for?"

Sweet Young Thing: "What shall I do? I am engaged to a man who just simply cannot bear children."

Kindly Old Lady: "Well, you mustn't expect too much of a husband."

PUT YOUR HAULING ON A *sure footing* FOR PROFIT

When ore stops moving, overhead starts climbing — and profits begin "taking it on the chin." But with hauling equipment that travels on its own tracks — "picking 'em up and laying 'em down" — interruptions are reduced to the minimum.

Take a "Caterpillar" track-type Tractor, hooked onto an Athey Forged-Trak wagon, and you have a hauling outfit without a superior for sure-footed traction and steady going. Neither snow nor ice, mud nor sand, ruts nor humps are apt to stop them.

With tracks that grip and ride over soft spots — with an engine that's powerful, dependable and truly economical — with protective devices which help vital parts resist dust, mud, grit and moisture — with sturdy construction that can take severe punishment . . . "Caterpillar" Diesel Tractors are the motive power for the severities of the mining and contracting industries. Their independence of footing, grade and weather conditions makes them invaluable where constant production is an important factor toward profitable operation. Let your "Caterpillar" dealer give you the full story.

CATERPILLAR TRACTOR CO., PEORIA, ILLINOIS

TWENTY-TON HITCH-HIKER — Back and forth, 16 hours a day, over a winding 17-mile trail from gold-ore bank to cyanide mill, go the "Caterpillar" Diesel D8 Tractors and track-type wagons of The Mountain Copper Co., of Matheson, Calif. They handle 20-ton loads per trip. These "Caterpillar" Diesel Tractors are also used for stripping.

CATERPILLAR

REG. U.S. PAT. OFF.

DIESEL ENGINES AND ELECTRIC SETS

TRACK-TYPE TRACTORS • ROAD MACHINERY

Field NOTES

A Shovel Rental Suit

When the B. Construction Company rented a power shovel to the W. Construction Company neither probably foresaw that the contract would result in a lawsuit that would go through three different courts and then go back to the trial court for a new hearing. But both companies probably learned some law that may help them when they rent or hire a shovel again.

The W. Company had a road contract and gave a bond to pay for all labor, materials and supplies used on the job. The company hired the shovel from the B. Company, and the evidence tended to show that the B. Company agreed to pay for the use of the shovel according to the yardage of sand clay top soil to be removed from a certain site. The evidence also tended to show that the B. Company used the shovel for the purpose of removing only a part of the soil removed under the excavation contract. That company's attorneys argued that it was liable only for pay measured by the yardage removed with the plaintiff's shovel. But the Alabama Supreme Court decided (John E. Ballenger Construction Co. v. Joe F. Walters Construction Co., 184 So. 275) : Where the lessee of a shovel agrees to pay the lessor as rent a sum measured by the quantity of material to be removed by him under his excavation contract, he cannot avoid payment of the full amount so agreed on by using the shovel for only a part, if it can be definitely shown what was the total yardage of material to be removed by the lessee under the excavation contract. In short, the lessee could not get off by using the shovel for part of his excavation work, and paying for the yardage removed with it, and use another shovel in removing the remainder. He must pay on the basis of the yardage he agreed to excavate with the rented shovel.

Another point decided by the Supreme Court is that a road contractor's bond to pay for labor, materials and supplies used by him on a job covers what he owes as rental of a power shovel used.

But the court decided that, under the statutes of Alabama, a suit on a road construction bond must be brought within sixty days after complete performance of the contract and final settlement with the contractor. — *Arthur L. H. Street, Attorney at Law*

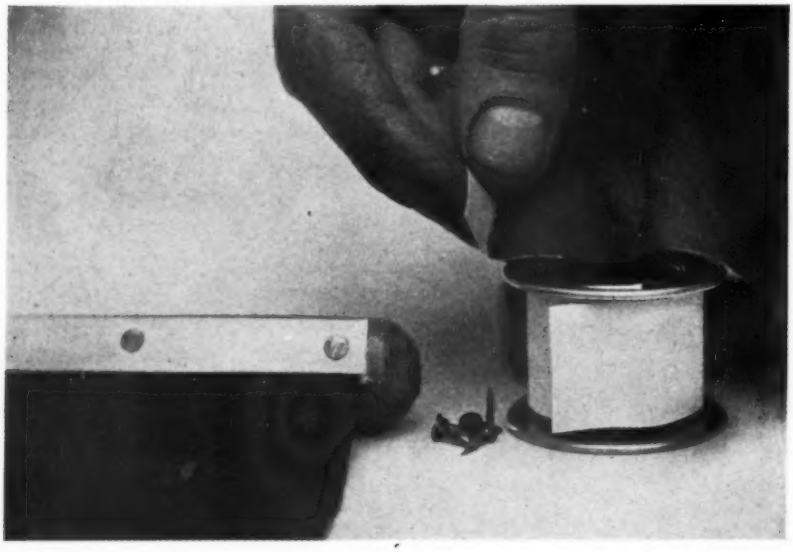
● By milling out the head of rivet hammers so they wouldn't slip off the head of a ten-inch spike, these air tools were used to good advantage in spiking together the timbers used in wood sheet piling at Imperial Dam on Merritt-Chapman-Scott's sub-contract. The spikes were started with a common hammer, driven through with the air hammer, and bradded down with a sledge.

Adhesive Tape Tacking Edge for Warning Flags

Pinnacle cloth and other light fabrics red in color and used for warning and caution flags soon tear along the tacking edge where they are fastened to small poles or sticks. A simple and very durable method of attaching them is shown above. Use a 1-inch strip of ordinary white waterproof adhesive tape. Fold the tape over so that about one half an inch of it will be on each side of the cloth. Press the tape down to the cloth firmly by running a hammer handle or some other hard object over the tape. This affords an excellent tacking edge for the light cloth. It will not tear or loosen when it is fastened to the staff.

—*Frank Bentley.*

● Applying a 1-inch strip of adhesive tape to the warning flag preparatory to fastening to a staff as shown lower left.



How Many Lengths?

We often want to compute the number of lengths of pipe, boards, rails, and such pieces necessary to make up a given length or distance, and it involves a problem in division. Longhand division is usually a tedious task for all of us and in this case it can be avoided.

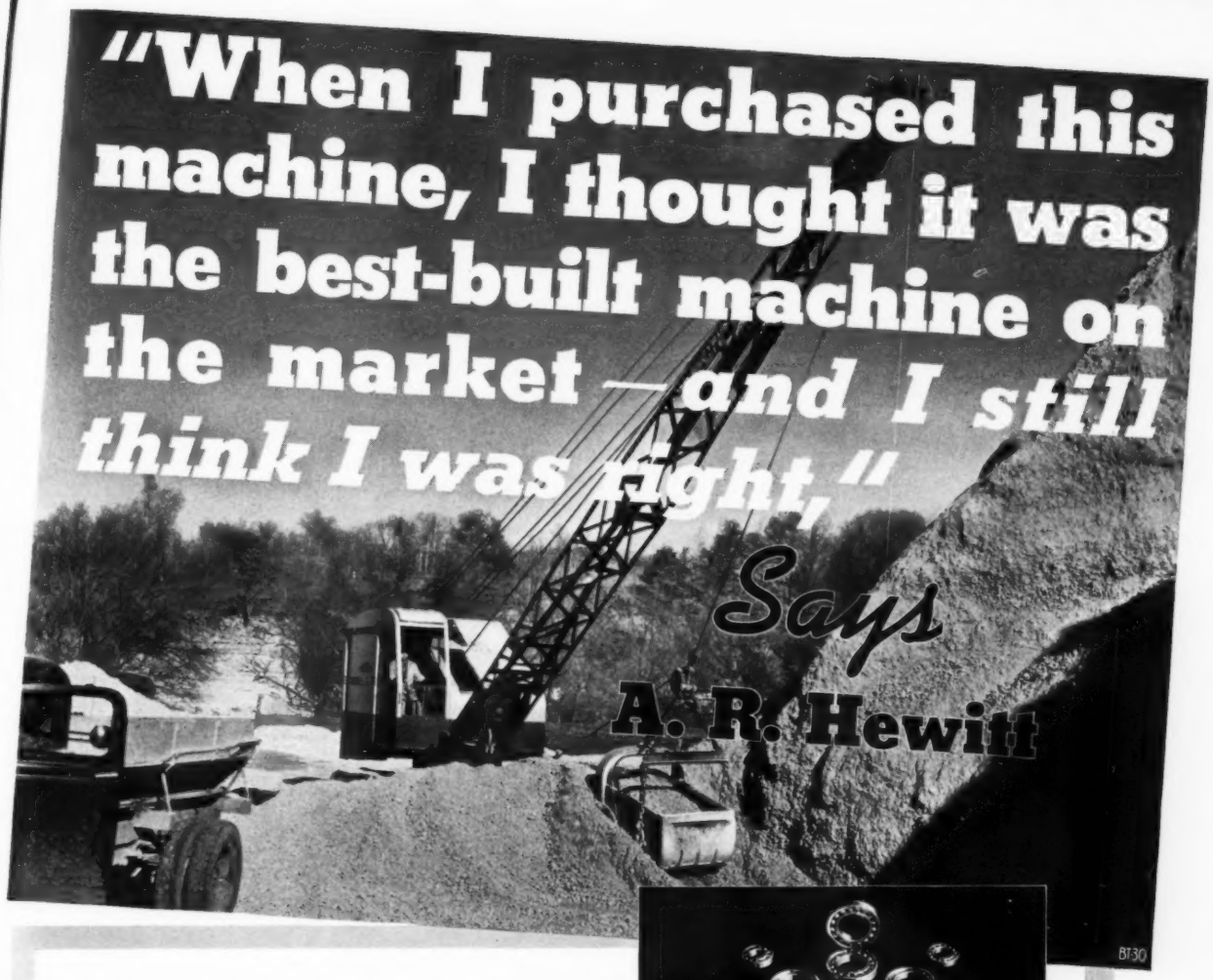
The chart shown will instantly give the answer by simply laying a straightedge across the chart. Or, merely stretch a thread across it. The number of pieces is indicated in column C.

For example, if a line of some kind 500 feet long is to be built and pieces 9 feet long are available, how many lengths, end to end, will be needed?

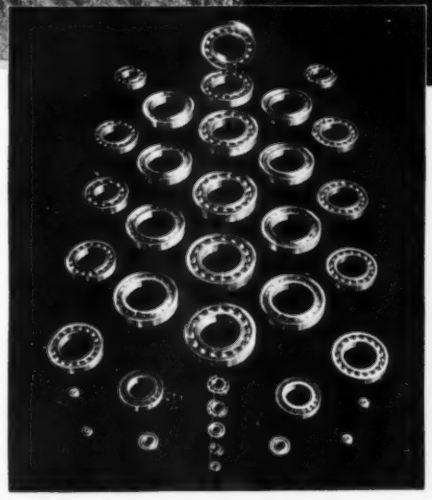
The dotted line running across this chart shows how easily it is done. Simply run the line through the 9, column A, and the 500, col-

"When I purchased this machine, I thought it was the best-built machine on the market—and I still think I was right."

Says A. R. Hewitt



Mr. Hewitt goes on, "I like its balance, the way it handles, its clutches and brakes. It keeps right on moving without a lot of short delays. Very easy on cables, fuel and oil." Hewitt Brothers, with headquarters in Fredericksburg, Iowa, cover a wide territory and a wide range of jobs with their 20-B dragline. Their average output in all classes of material is 75 bank yards per hour, at a gasoline cost of 40 cents, using a ¾-yard dragline bucket.



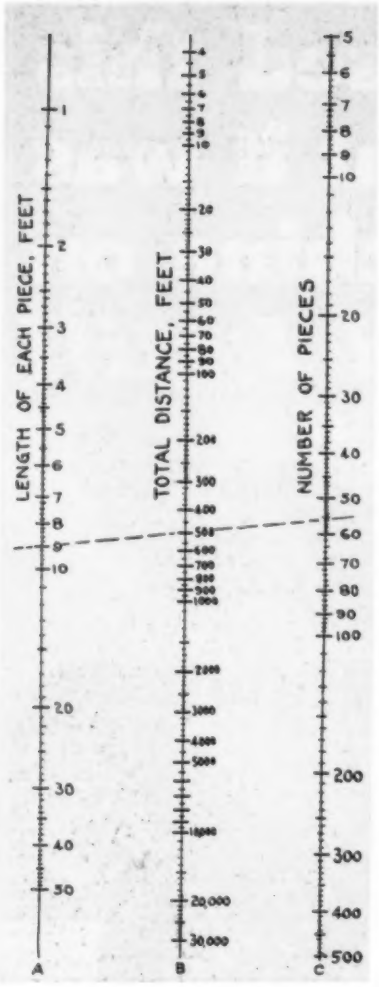
The 37 anti-friction bearings used on the 20-B are just one of the quality features—one of the reasons why the 20-B *continues* to give top performance with minimum maintenance requirements throughout a long life.

Bucyrus-Erie

SOUTH MILWAUKEE WISCONSIN

BUCYRUS ERIE

For your convenience in writing to Bucyrus-Erie Co., you will find a card bound in this issue.



● Clip this handy computing chart and mount it on cardboard. You will find it a handy aid for fast estimating.

umn B, and the intersection with column C shows the answer to be slightly over 55. In other words, about 56 pieces will be required to make up the total distance of 500 feet.

It will be noted that the range of the chart is very great. It will take care of a total distance varying from 4 to 30,000 feet. The length of each piece may vary from 1 foot to 50 feet, and it will take care of any number of pieces from 5 to 500.

As a matter of fact, the chart has no limitations whatever. By simply adding two ciphers to any figure in column B, two ciphers would have to be added to the figures in column C. Thus, if the total length were 50,000 feet instead of 500, the same dotted line drawn across this chart would give the answer as, "about 5,600 pieces" instead of 56. Or, if the total distance were 500,000 ft., which means that three ciphers are added to column B, the answer in column C would be "about 56,000 pieces."

After giving a chart a trial you will welcome simplicity, fast accuracy and general usefulness. It is excellent for use in estimating or for checking up one's longhand figures.

—W. F. Schaphorst, M.E.

Simple Lubricant Tests

Here are five simple and understandable field tests for determining roughly the comparative values of lubricating oils for journals that require staying power, film strength, and efficient transmission. Tests 1 and 2 demonstrate staying quality. Test No. 3 —shock resistance. Tests No. 4 and 5—lubricity. In performing these tests no "laboratory equipment" whatever is required.

Test No. 1. Dip your thumb and forefinger into the lubricant. Open and close the finger and thumb and note how the oil adheres. Its adhering property is an indication of whether or not it will run out of the bearing. Adherence is desirable in many bearings.

Test No. 2. Place equal-sized drops of two oils having the same viscosity on a glass plate. Tip the plate to a nearly vertical position. The oil showing the greatest resistance to flowing down the plate is preferable.

Test No. 3. Place on a steel plate equal-sized drops of two or more oils having the same viscosity. Hit each drop with a hammer and note how the oil is flattened out and splatters. The oil that does not splatter is preferable because it is most likely to prevent metal to metal contact under severe shock loads.

Test No. 4. Place a small amount of the oil in the palm of your hand and rub vigorously. A thin clear film should adhere to all surfaces touched and should not be rubbed away. There also should be an absence of frictional heat.

Test No. 5. Place the lubricant in an open-mouth jar. Dip a wide piece of metal or cardboard into the oil and then lift it above the jar to a height of from 12 to 18 inches and note the film. The broader the jar and piece of metal, the broader will be the film. Ordinary mineral oils subjected to this test will flow from the plate rapidly and splash and splatter. A first class lubricant will flow off in the form of an even film.—*W. F. Schaphorst, M.E.*

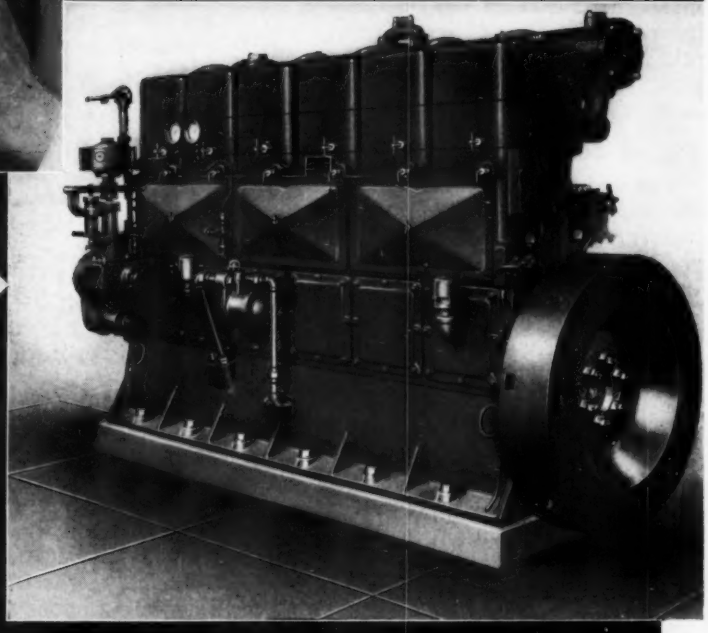
Ramrod Attachment for Oil Can Spout

Seemingly contradictory to all of the known laws which govern the action of falling bodies, the common spring bottom oil can on an accidental downward plunge invariably hits point first, usually plugging up the opening at the tip of the spout. This results very often in an aggravating job to hunt up something which will just go through the opening to dislodge and push out the obstruction. To eliminate this trouble procure a small piece of wire that will just neatly go through the opening at the tip of the spout. Bend an eye in it at a right angle as shown and of a diameter to fit the tapered spout some distance down from the tip so the wire will lay snugly against the long cone. This handy ramrod is not in the way at any time during the use of the oil can, yet it is always ready for use when the usual mishap plugs and stops the opening in the end.

—Frank Bentley.

● A handy spout cleaner of this type will save you many irksome moments with a plugged oil can.

Why Gamble with "POWER Shut-downs?"



ATLAS DIESELS OF THE ENCLOSED TYPE ARE AVAILABLE IN 4, 5, 6, AND 8-CYLINDER MODELS.

YOU are not playing "penny ante" when you select your power for a large construction job. When competition is especially keen, you may have taken a contract on a very close margin. A short profit means "one strike" against the job at the start.

Whether the contract is a penalty and premium job, or if the loss is confined to idle men and equipment, power shut-downs are always expensive. When the rock crusher isn't crushing and no material is coming from the hot mix plant, idle men and machinery are eating up your profits.

When there is so much at stake, power with Atlas Diesels, the engines that have proven themselves dependable over a period of many years. You can count on them no matter how tough the going or how hard the rock. They will carry through when lighter engines stall and stutter. You can bank on their performance.

ATLAS IMPERIAL DIESEL ENGINE CO.

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CENTRAL DIVISION . . 228 NORTH LA SALLE ST., CHICAGO, ILL.
S.W. DIVISION . . 5726 NAVIGATION BLVD., HOUSTON, TEXAS
WESTERN DIVISION . . 1000 19TH AVENUE, OAKLAND, CALIF.

ATLAS Imperial DIESEL ENGINES

For your convenience in writing to Atlas Imperial Diesel Engine Co., you will find a card bound in this issue.

Kiirunavaara Iron

(Continued from page 223)

the latter type also used in drifts and cross-cuts. Sticks of 50 per cent dynamite are used, and it is estimated that 6 to 8 tons of ore are broken per kilogram (2.2 pounds) of dynamite used and 3 to 3½ tons for each meter (3 1/6 foot) drilled. Ordinary fuse is employed in the drifts and cross-cuts and electric detonators in the stopes and raises. Scrapers are used for handling the broken ore in the drifts; some are operated by compressed air motors and others by electric motors. The loading capacity of each scraper is about 10 tons per hour.

Use of Central Loading Tunnel

The main loading tunnel, which serves both the stripping and the underground operations, runs right under the entire length of the ore body as previously mentioned. Trains of empty cars are run into the tunnel, loaded and then transported across the 106 miles to Narvik for shipment. In this way, rapid and simplified handling of the ore has been rendered possible. There are four loading pockets situated in the tunnel; three are fed from the crushing stations on the open-cut workings and one by the skips from the underground workings. Ore is discharged into cars through doors operated by compressed air. The average train is made up of about 44 cars with a capacity of 45 tons each.

● This shed contains the chutes through which the ore cars dump to the crushers which in turn feed the pockets in the main haulage tunnel.

The port of Narvik in northern Norway is the shipping point for practically all of the ore from Kiruna. This port, although well inside the Arctic Circle stays open during the winter, as the gulf stream prevents the surrounding waters from freezing. The 106 mile railroad to Narvik is a fine feat of construction work through very mountainous country and is one of the earliest electrified railways in the world.

At the stock piles in Narvik the ore is loaded by the previously mentioned Bucyrus-Erie railroad shovels into 35 ton ore cars which take it to the loading wharf, where it is dumped down steel gravity chutes to the ships. There are alternative lengths of chute to take care of the tidal variation which in Narvik may vary from 1 to 3 meters (3 1/6 to 9½ feet).

Modern methods have resulted in a rapid loading rate and a 10,000 ton steamship can be loaded in 5 hours. The wharf can accommodate three steamships in simultaneous loading operations.

Winter Loading Problems

The important problem of winter loading is the dumping of the ore cars which arrive at the port with frozen contents. Various methods have been devised to solve this problem. If the ore is not too badly frozen, brine is pumped into the wagons and they are left to stand for a certain period to thaw. Powerful air hammers are also used to vibrate the sides of the ore cars to help loosen the contents. There are special holes in the sides of these cars to allow the attachment of steam nozzles so that steam may be injected for a period. Fuel oil torches are sometimes employed to warm the sides of the cars. In extreme cases it is necessary to pick up the wagon bodily by a special tipple and turn it over to dump out the frozen ore which falls as a mass on a steel knife edge that causes suitable breakage. Stock piles are kept well soaked with brine to minimize the freezing as much as possible.

Kiruna and Narvik form an interesting and colorful background for the constant activity of men and machines in their endless search for the earth's treasures.

● General view of Kiruna stripping operations shows the face just after a shot.

Mountains, lakes, and fjords are mantled in beautiful blues, violets, and purples—colors which are characteristic of these northern climes. An added touch of beauty and unusualness is the annual appearance of the "midnight sun" from July to August.

It somehow seems fitting that such an enormous and rich mass of iron ore, calling for such gigantic human endeavors, should be located amidst such magnificent surroundings.

Fresh Water . . .

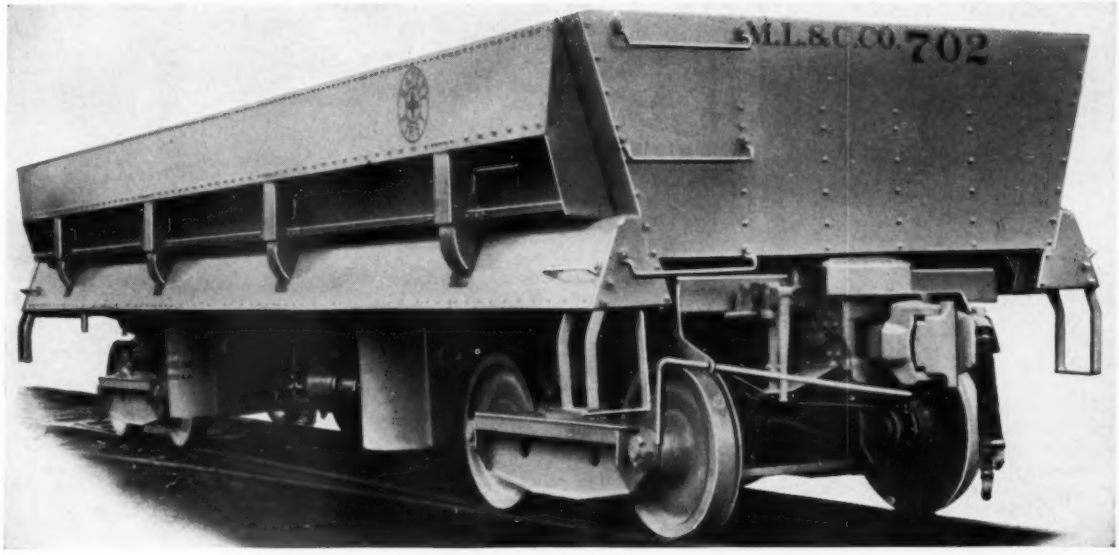
(Continued from page 219)

plied under pressure in one operation. The cement coating is 2½ inches thick and the lining one inch, making an overall thickness of about four inches. The small end of the pipe has a narrow groove into which oakum is fitted before the lock joint flange is forced over it.

The pipe was subjected to a hydrostatic test of 200 pounds and a maximum static pressure of approximately 125 pounds per square inch. Manholes are spaced about two miles apart, are of 24 inch diameter, and are tested to 200 pounds per square inch.

Automatic valves have been located at high and low points along the line which will permit air to escape from the filling line, expel air accumulating at high points, allow air to enter in case of a break, and break a vacuum caused by opening a valve below a break.

DIFFERENTIAL AIR DUMP CARS
WITH
AXLESS TRUCKS



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- **AXLESS trucks are free wheeling —Reduce wheel and rail wear— Cut down rolling resistance.**
- **AXLESS trucks provide high degree of roadability over poorly lined and surfaced track.**
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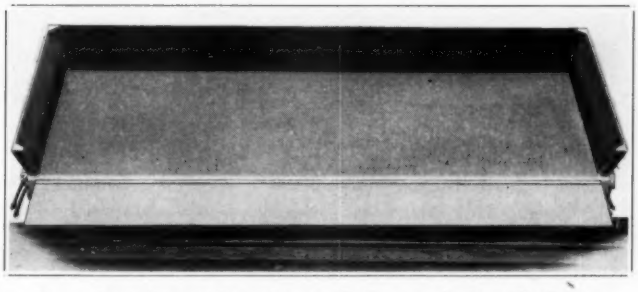
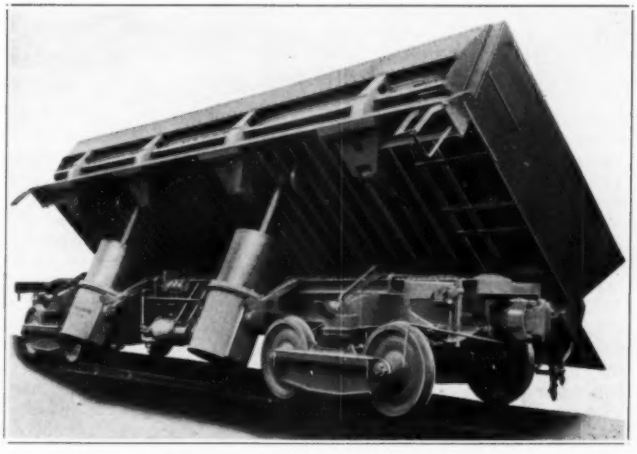
Burden-bearing Locomotives — Mine Locomotives — Mine Cars — Stockpile Cars — Larry Cars — Complete Haulage Systems.



Steep dumping angle and smooth floor and clear discharge opening for any size or class of material.



Sturdy construction — high payload ratio.

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Shots from the FIRING LINE

Ground Broken for New Sepulveda Dam

by Floyd Suter Bixby

While approximately 1,000 residents of the San Fernando Valley cheered, construction work officially began February 15 on the new $8,000,000 Supelveda Dam across the Los Angeles River near Van Nuys, California, 35 miles northwest of Los Angeles.

The order for construction to proceed was given by the U. S. Army's own Lieut. Col. Edwin C. Kelton, district engineer for the Los Angeles district of the U. S. Engineer Department, who then picked up a shovel and set the work in motion. A note of lovliness was lent to the proceedings when Miss Jane Wyman, Miss Helen Parrish and Miss Peggy Moran, actresses from nearby Hollywood motion picture studios, appeared on the scene to assist the district engineer.

Sepulveda Dam, located north of Supulveda Blvd. with Victory Blvd. on the east and Ventura Blvd. on the west, will be 500 feet thick at the base, 30 feet wide at the crest, 50 feet high, and will curve in inverted horseshoe fashion for 15,000 feet over its crest length across the retarding basin. About 2,735,000 cubic yards of rolled earth fill will be placed in the structure by the Jahn-Bressi-Bevanda Construction Company of Los Angeles, who have been allowed one and one half years in which to complete the project.

"This is really a happy day for us," declared Col. Kelton.

"You know we engineers, after months and sometimes years of preparatory planning, are always glad when actual construction on a project begins.

"We are here today to start another step in Los Angeles County's huge flood control program. This is just one structure on the program, but a very important one. Sepulveda Dam, when completed, will be able, with the basin above it, to control a flood of 65,000 second feet of water. This peak flow can be held back and reduced to 6,500 second feet for the channel below, averting flood damage to homes and industries below the dam."

All of the financing has been done by the Government under 1936 and 1938 acts of Congress providing money for Los Angeles County flood control projects built under the supervision of the army engineers. Even the right of way was purchased for the dam by the Government.

Roger W. Jessup, chairman of the Los Angeles County Board of Supervisors helped Col. Kelton with the initial ceremony, as did Willard A. Smith, chairman of the flood control committee of the Board of Supervisors. Short addresses were given by the mayors of three nearby cities: Mayors W. R. Hinton of Burbank, J. Leo Flynn of San Fernando, and W. J. Goss of Glendale. Representatives of a score or more civic groups and the Los Angeles Chamber of Commerce also took part in the program.

● A note of loveliness is lent to the Sepulveda Dam ground breaking ceremonies as three Hollywood "starlets" help Supervisor Roger W. Jessup start construction operations.

Penn Turnpike Nears Completion

Pennsylvania Turnpike Commission authorities report that, as of January 31, 65 contractors had earned a total of $24,991,339.11, of which they had been paid $22,496,018.37. Their total payrolls to that date amounted to $8,745,565.48, covering a total of $11,155,285½ manhours of employment on the Turnpike.

Contractors' payrolls are expected to reach upwards of 20,000 men during the spring paving drive which will start early this month. To rush the highway to completion by the June 29 deadline fixed in the PWA grant agreement, 30 contractors using about 50 complete outfits will be paving simultaneously all along the Turnpike at top speed.

Progress reports show that virtually all grading and drainage is completed along the 160 miles. This work grades and compacts the roadbed preparatory to placing of the concrete surface. Excavation of the seven tunnels is 82 per cent completed and the work is expected to be finished by May 1. The first tunnel, Rays Hill, was "holed through" January 22. Undriven portions remaining in the other six tunnels are: Blue Mountain, 565 feet; Kittatinny, 296 feet; Tuscarora, 765 feet; Sideling Hill, 1,286 feet, Allegheny, 2,208 feet; and Laurel Hill, 1,032 feet.

Yakima Ridge Canal Contract

A contract covering a short section of the Yakima Ridge Canal, Wasteway No. 2 and a protection dike, Roza Division of the Yakima project in Washington, has been awarded J. A. Terteling and Sons of Boise, Idaho, by government authorities.

Terteling's successful bid of $98,870.50 was the lowest of seven proposals received and opened by the Bureau of Reclamation at its Yakima, Washington, office.

This 915-foot section of the Yakima Ridge canal with Wasteway No. 2 will complete a gap in the main canal. Over a mile in length, the wasteway crosses five private irrigation ditches, three roads, a branch of the Northern Pacific railroad and requires a dike to protect land against high water in the Yakima river.

More than 222,700 cubic yards of material will be excavated for the canal, wasteway, dike and other structures; 191,900 pounds of structural steel will be erected in bridges and in flume and pipe supports; and 264,500 pounds of reinforcement bars will be placed in the

you've always wanted in a scraper

BUCYRUS ERIE

You get exactly the depth of spread you want with the new Bucyrus-Erie 4-Wheel Scrapers. As dirt is rolled out of the bowl it is leveled off by the cutting edge. Since this cutting edge is fixed in the frame and controlled independently of the tilting of the bowl by a separate line of cable, it maintains the depth of spread you want at all times. ¶ You also get positive rolling ejection, by means of the tilting bowl. This bowl is a simple reinforced plate, curved below and behind the dirt, and hinged immediately behind the cutting edge. Controlled by an independent line of cable, it ejects the dirt in a rolling motion when tilted upward. It can be tilted to a nearly vertical position, and this sharp angle of tilt plus the shearing action along the side plates of the frame assures you clean dumping of any kind of material.

Of course the new Bucyrus-Erie scrapers have all the other features you want too. There is a complete range of sizes matched to the new line of International Trac-TracTors. Find out all about them from your nearest International Industrial Dealer.

Bucyrus·Erie

SOUTH MILWAUKEE, WISCONSIN

● Soft coal to be made into smokeless fuel is strip-mined by a Bucyrus-Erie 750-B for the Midwest Smokeless Fuel Corporation at Millstadt, Illinois. (Photo courtesy St. Louis Post-Dispatch)

concrete, in addition to other materials.

The section of the main canal will be lined with concrete, except at a check structure and the wasteway.

Agreements have already been executed for the wasteway and dike to cross existing canals and sloughs. The wasteway crosses the Selah-Moxee Canal, the Moxee Co. Canal, a slough, the Union Gap Canal, and the Richartz Ditch. The protection dike crosses the Moxee Co. Canal and Union Gap Canal.

Several highway bridges will be constructed in addition to the Northern Pacific Railroad bridge. The contractor will build a roadway to detour the railroad traffic around the structure site while the bridge is being constructed. Terms of the contract call for completion of all work within 350 days.

The 87-mile Yakima Ridge Canal, which will carry stored water diverted from the Yakima River at the Roza Diversion Dam to 72,000 acres of dry land in this new division of the project, is now about half completed. Water probably will be delivered in 1941 to irrigate approximately 10,000 acres.

Arthur Johnson Corporation Wins Suit

Judge F. Delano Putnam, acting as auditor in a suit brought by the Arthur A. Johnson Company of New York against the Metropolitan Water Commission, recommended in finding recently, an award of $285,139.50 for the Johnson Company, saying the company had suffered from what in effect was a fraud in connection with a contract for work on the Quabbin Reservoir.

The Johnson Company contended that the commission was guilty of a breach of warranty in that it failed to give proper data on which to base bids for building a mile-long dike at the site of the reservoir. The Johnson Company obtained the contract but discovered that the earth specified to be excavated for use in an embankment was in fact hardpan, and had to be dynamited. The company lost heavily on the contract.

Suit was brought charging that the water commission failed to give proper description of the earth to be excavated and misled bidders. Judge Putnam found that the company's contention was correct and that although conditions were known to the engineers the facts were omitted from data supplied to bidders. The state's attorney-general's office declared that the case would be contested to the supreme court if necessary.

Start Willamette Project

by F. N. Hollingsworth

Flood control for the fertile Willamette Valley in the heart of Oregon will start soon, bids having been called on the $2,600,000 dam, which will be built northwest of Eugene at a point on the flat prairie known as Fern Ridge. This ambitious $62,000,000 project to foil the too-wet and too-dry flow of a vast river system, is nearing actuality under the direction of U. S. Army engineers. The project will also provide ample water during the long dry summer, when the dwindling streams play havoc with irrigation systems now existing, until the fall rains come again.

With the actual construction of the Fern Ridge Dam, the first of seven practical dams, farmers and other residents will not have to worry when the clouds begin to gather in the wet, wintry season. Already bulldozers have removed all brush and trees from approximately 500 acres of the site, ready for actual earth embankment and concrete dam construction.

The engineers' plans call for seven dams and basins, which will serve as gigantic "valves" for the river floods. Storage reservoirs will hold back over 400,000,000 gallons of flood waters, the engineers estimating that 75 per cent of the run-off in the Willamette drainage area can thus be controlled.

Beside flood control there are four other uses for the dams and basins. The more regular flow of water will improve navigation; streams will be purer; irrigation will be aided and there are great hydro-electric power potentialities. Three of the seven dams, at Fern

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reveal excellency based on years of specialized experience.
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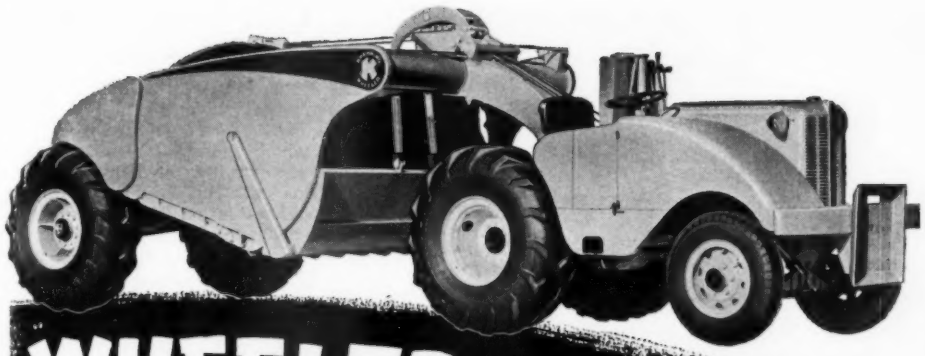
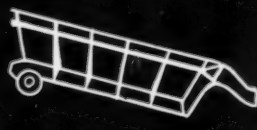
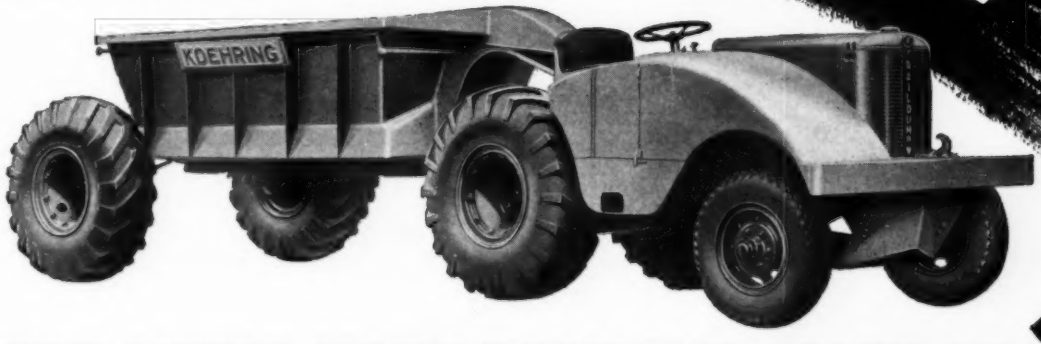


Koehring Wheeler with crawler push tractor loads faster. Travels faster because of high speed rubber tired tractor.

WHEELER and TRAIL-DUMP = 2 in 1



Koehring Trail-Dump with high speed rubber tired tractor travels faster. Instantaneous gravity dump and "mechanical hand" door wind saves seconds.



2 FOR LITTLE MORE THAN THE PRICE OF 1

Two types of hauling units in one. Koehring Wheelers are quickly changed to Trail-Dumps. Same tractor, same tires, same wheels and hubs, same hitch . . . only change is the body . . . cable control unit need not be removed . . . Trail-Dump to Wheeler similarly. Different job conditions no longer require investment for complete new hauling systems. Change is easily and quickly made on the job. For little more than the price of one you now can own *two complete hauling systems* . . . the Koehring Wheeler, push-loading, high speed unit . . . or the Koehring Trail-Dump loaded by shovel, dragline, clamshell or elevating grader. Descriptive bulletins of the Trail-Dump and Wheeler will be mailed at your request.

KOEHRING COMPANY · MILWAUKEE, WISCONSIN

KOEHRING HEAVY DUTY

HEAVY-DUTY CONSTRUCTION EQUIPMENT

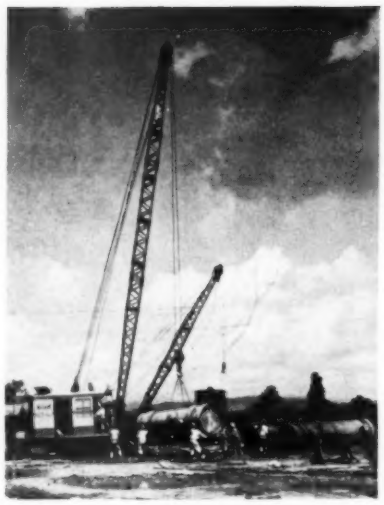
For your convenience in writing to Koehring Co., you will find a card bound in this issue.

Ridge, Cottage Grove and Dorena have already been started, with the balance of the structures planned for later completion.

The Fern Ridge reservoir will have a storage capacity of 31,000,0000 gallons and will serve a drainage area of 252 square miles. The main portion of the dam will be about 50 feet high and the maximum depth of the pool about 40 feet. This pool will extend seven miles up the Long Tom River and Coyote Creek. At the widest part it will be 4½ miles. Some farm land will be covered, but about one-third of the area is marshy bottom land of little value. When completed the Fern Ridge Dam will consist of a rolled fill dam and two dikes almost 10,000 feet long. Except for a concrete, gate-controlled spillway and outlet, the structure will be of earth.

Located at the western end of the main dam, the spillway will be 300 feet long and will require about 10,000 cubic yards of concrete, about half of which will be reinforced. Approximately 16,000 cubic yards of rock blasting will have to be done to make way for the spillway.

Specifications for the Cottage Grove Dam should be ready for bids within a few months. Work on the Dorena Dam has been delayed by difficulty in locating a good site. Engineers are now engaged in soil, exploratory and survey work similar to that for the Fern Ridge Dam. It will reach a maximum height of 125 feet when completed.



● Two Bucyrus-Erie machines, a 37-B and a D-2, install storage tanks at Caripito, Venezuela.

Each of the four other project dams, at Lookout Point on the Middle Fork, Quartz Creek on the McKenzie, Sweet Home on the South Santiam and Detroit on the North Santiam, will have a storage capacity of above 250,000 acre feet.

Texas to Observe "Highway Week"

The Texas Highway Commission has tentatively set aside the first week in October as "Texas Highway Week" during which those interested in furthering the progress of Texas through completion of the highway system might call attention to the essential services rendered in the past by highways and review the present and prospective highway needs of Texas.

Matters affecting highway finance, new procedures developed in construction and maintenance of roads, highway safety and highway economics will be stressed during the week.

In designating the week, the Highway Commission stated, "highway transportation has contributed immeasurably to the progress of Texas and has been a prime factor in development of commerce, agriculture and industry within the state. Texans, in general, firmly believe in a sound public policy whereby the construction and maintenance of an adequate system of connected highways is assured. The construction and maintenance of highways daily touches the lives of more of our people than any other governmental activity. It is the belief of this Commission that a people enlightened on the subject of highway transportation and aware of its important place in Texas' social, economic and recreational

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Williams Buckets have always featured more welding in bucket construction than any other manufacturer.

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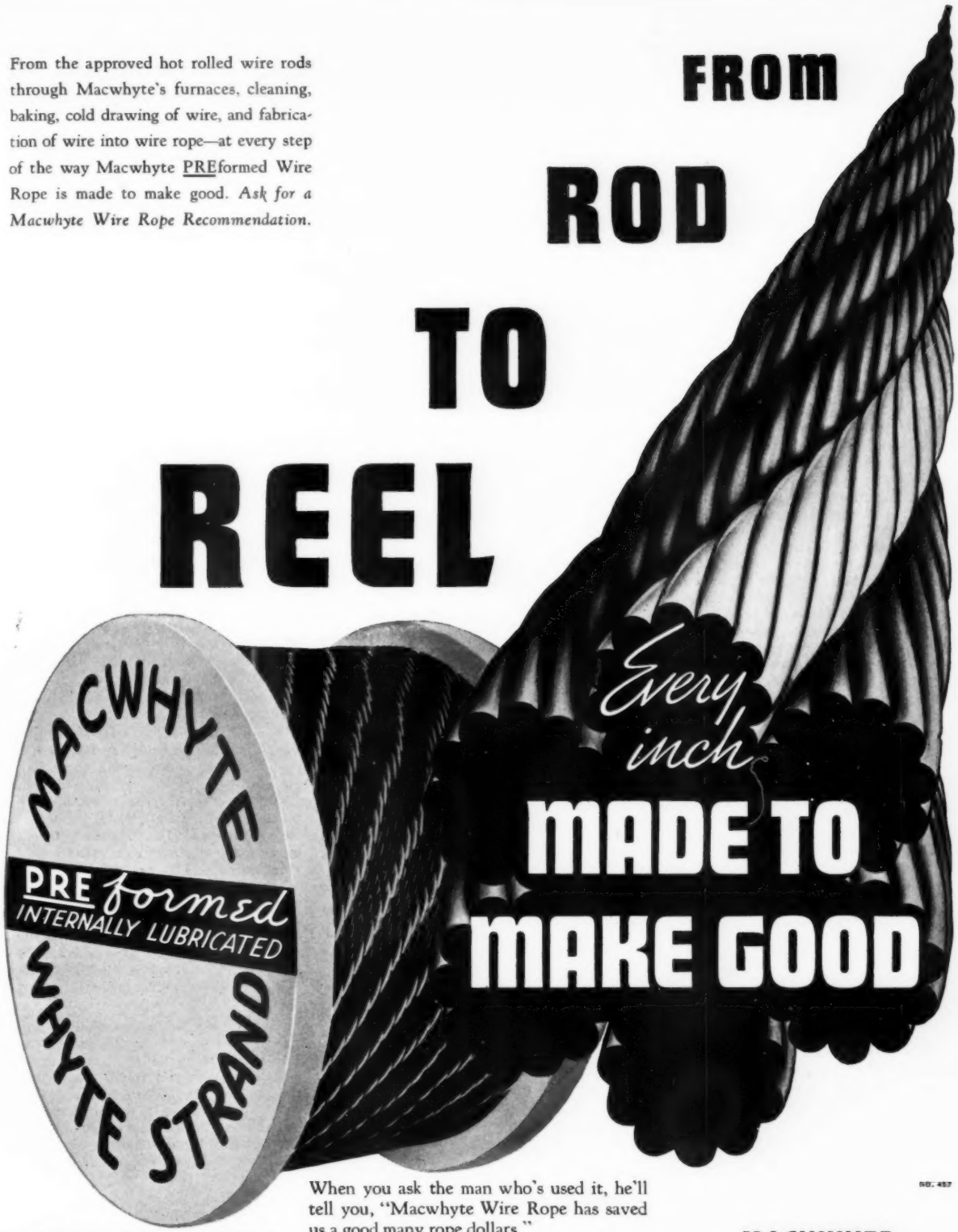
FROM ROD TO REEL



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life will best safeguard the continuation of a highway program on a firm and progressive basis."

"Few Texans realize that with four-cents per gallon state gasoline tax, less than two cents goes to the construction and maintenance of the primary rural highways carrying the bulk of the traffic. One cent of the gasoline tax goes to the schools and one cent goes to the retirement of county road debts and other county expenses. Few persons also realize that only about one-third of the motor vehicle registration fees are available for primary state highway construction, the remaining two-thirds going to the county road and bridge funds."

Friant Dam Activities

Central Valley Project builders are getting ready to push the San Joaquin River aside at the Friant Dam site in preparation for placing the first concrete in the base of the dam after high water subsides in the spring.

With the excavation for the foundation of the dam getting down to hard rock in several places on the abutments, a 1,700-foot temporary diversion channel is being cut along the south bank of the river to carry the low summer flow while work on the dam is extended to the present stream bed area.

Friant Dam is being constructed by the United States Bureau of Reclamation for supplemental irrigation and flood control in the San Joaquin Valley.

● View of the Friant Dam site. Engineers have indicated the actual size and location of the dam by a giant pattern of white lines.

Construction Engineer R. B. Williams said the time of river diversion, and hence the subsequent time of starting concrete placement, depends upon the weather and when the danger of a heavy flood is past.

The channel, 50 feet wide, is designed to carry a peak flow of 10,000 second-feet. For most of its length the bottom and side slopes will be lined with gunite concrete. For a distance of 250 feet across the dam excavation the channel will consist of a timber flume supported on trestle bents.

The river will be turned into the channel by an upstream cofferdam now being constructed. It will consist of concrete walls bulwarked by earth and rock, with a 25-foot section in the center to be closed at the time of diversion by steel and timber fillers. The downstream cofferdam will be a rock-fill timber crib. Pumps will keep the area between cofferdams unwatered to permit stream bed excavation and concrete placement in the lowest part of the dam this summer.

Meantime, the Friant Dam contractor, Griffith Company and Bent Company, having completed a construction camp on the Fresno County side of the river, is proceeding with the foundation work on both abutments. About half the estimated 770,000 cubic yards of earth and rock to be excavated has been removed to date, using seven 15-yard wheeled scrapers to strip the surface material and four 2¼-yard diesel shovels to handle the heavier muck which is loosened by drilling and blasting. The scrapers and a fleet of 5½-yard trucks transport the material to waste dumps upstream from the dam site.

Dynamite holes are drilled by a battery of 14 wagon drills and 20 jackhammers, operated by compressed air which is delivered to all parts of the dam site by steel pipe and armored hose from a seven-unit compressor plant capable of furnishing 7,000 cubic feet of air a minute. The air leaves the compressors at a pressure of 100 pounds and reaches the farthest drills, 3,000 feet away, with a loss of only five pounds of pressure.

A 12-ton capacity steel stiff leg derrick with a 180-foot boom has been erected high on the south abutment and is engaged in building the concrete mixing tower, a hexagonal steel building 104 feet high. The derrick, a veteran of Boulder Dam service, later will be used to erect other structures and to place some of the concrete in the extreme southerly end of Friant Dam

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Sauerman Slackline Cableway digging hard-packed gravel from bar in the River Cazones, Mexico.

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beyond the limits of a proposed construction trestle.

Other Friant equipment also has seen service in recently heavy construction jobs. Two concrete mixers already installed have been brought from Conchas Dam in New Mexico. Griffith and Bent announced two hammer-head cranes will be purchased at Grand Coulee Dam and re-built at Friant. These and two whirley cranes will place most of the 1,850,000 cubic yards of concrete in the dam.

The cranes will travel on a 2,200-foot structural steel trestle which is to be constructed across the dam site as soon as the excavation is down to bedrock. The hammerheads, of 12-ton capacity, will be 72 feet high and will have 300-foot arms. The whirleys, also of 12-ton capacity, will be 53 feet high and will have 125-foot booms. They will handle the four-yard concrete buckets which will be hauled out on the trestle from the mixing plant by seven 10-ton diesel-electric locomotives.

More than 250,000 cubic yards of overburden has been stripped to date from the gravel deposit along the San Joaquin River about three miles below the dam site. Construction is proceeding there on an aggregate plant that is to process an estimated 3,200,000 tons of sand and gravel. The steel framework for a screening tower is up, a gyrator crusher is in place, and various overhead conveyors, recovery tunnels and loading hoppers are being built.

Sand and gravel will be transported to stock piles at the dam site over a 2½-mile standard gauge railroad, for which grading is under way. One of two large diesel-electric locomotives to be used to haul aggregate trains already is in use in the railroad yard downstream from the dam. From the stock piles, sand and gravel will be carried to bins at the top of the mixing plant by means of a quarter-mile belt conveyor system, grading for which has started.

Two plate steel cement storage silos, each of 5,900 barrels capacity, have been erected alongside the railroad and two more are to be built. The cement will be blown to the mixing plant through an eight-inch pipe about 900 feet long. The plant will have four 4-yard tilting concrete mixers.

Completed shop buildings include the compressor house and a riggers' and electricians' loft near the mixing plant, and at a lower elevation a large warehouse, carpentry shop, drill sharpening shed, welding shop, machine shop, blacksmith shop, grease rack, and truck garage. A 500-foot timber bridge has been built across the river opposite the shop area below the dam site to connect the Fresno County and Madera County sides of the job.

With work proceeding day and night, about 750 persons are employed by Griffith & Bent. One 32-room dormitory is occupied and a duplicate is under construction. Other completed buildings include a two-story office, an automobile garage, a 112-seat mess hall, a small hospital, and six family residences for some of the contractor's staff. Most of the workers drive to the job from their homes in nearby cities. To facilitate the flow of automobile traffic, separate parking areas have been graded for the day and night shifts.

The Bureau of Reclamation engineers, clerks, inspectors and surveyors are quartered in a Government camp a mile downstream from the dam site. Composed largely of family residences, the camp has a present population of about 140.

Visitors to Friant Dam, who have been coming in large numbers on holidays and week-ends, are directed by signs to a 500-car parking area and observation point which has been graded near the top of the south abutment. Visitors are barred from the construction area by a high wire fence erected entirely around the job.

● **Vernon Brothers Company of Boise, Idaho, put their 1-yard Bucyrus-Erie dragline to work on the excavation of Crane Prairie Dam near Bend, Oregon.**

New Jersey's Super-Highway

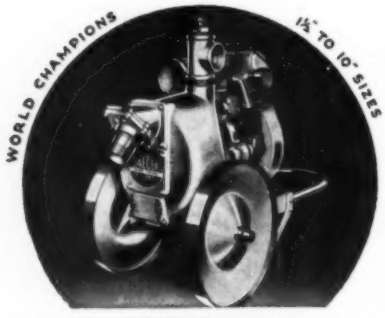
Advancing his highway improvement program for the badly congested Northern New Jersey area, State Highway Commissioner E. Donald Sterner recently announced his authorization of preparation of final plans for construction of an eight lane super-highway along the present alignment of Route 25 (U. S. 1) in Newark.

Approximately $1,000,000 has been allotted for paving and bridge construction on the improved stretch of highway, which is designed to eliminate traffic congestion in the vicinity of Newark Airport. Based on actual traffic counts, which reveal an average daily flow of 60,000 vehicles, Route 25 has become known as "the nation's worst point of traffic congestion."

Grading operations in preparation for widening and construction of the improvement have been underway since July, when Santaniello Bros., of Jersey City, were awarded a contract for that work on a low bid of $336,242. Due to the traffic density in the area, Commissioner Sterner has required the grading contractors to carry out their work without blocking any of the present roadway. The same requirement will be included in the bridge and paving contracts.

The present 50-foot roadway will be part of the new highway, which will consist of four pairs of 12 foot lanes, totaling 96 feet of paved surface, each pair separated by a safety island. The two center sections will be for fast, through traffic, while the outside section will be for local traffic and slow moving vehicles.

All intersections at grade on the present roadway will be eliminated through the construction of overpasses



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A shielded, Type SH, cable similar to the type used on this big gold dredge

THE fact that this company, a big gold-mining property on the Pacific Coast, has selected G-E tellurium-rubber cable for its dredge No. 5, testifies to the ability of this cable to stand up under such severe service.

The cable shown in the pictures is a shielded type (Type SH), 3,000 volts, three-conductor, 350,000 cir mils, 1200 feet long.

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This cable is flexible and does not readily kink; it is light in weight and small in diameter. It has a smooth surface and is little likely to pick up weeds, trash, dirt, or other foreign material. All these features save time in moving the dredge or shovel.

The tellurium-rubber jacket is tough and capable of resisting much abrasion and has long-aging qualities.

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The constant increase in size of electric shovels and dredges has made the task of selecting a type of trailing cable difficult. Voltage, loading cycles, heating, regulation, protection to workmen, economics—all these factors must be taken into account.

You profit most when the cable is right for each job. To this end, make full use of the services of a G-E cable specialist and get the most for your cable dollar. He can help in the selection of the *right* type—for long-term economy. Address nearest G-E sales office or General Electric Company, Dept. 6—201, Schenectady, New York.

ALWAYS THE RIGHT TYPE FOR EACH JOB

GENERAL ELECTRIC

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and underpasses. Five grade separations and two crossovers will be included in the three and two-tenths miles of the new highway, extending from the Newark viaduct to the Elizabeth city line.

A modern intersection of diverging highways will eventually be constructed near the Elizabeth boundary, at which point Legislated Route S-100 will join Route 25 and form a connecting link with Legislated Route 100, the proposed New York-Perth Amboy multi-lane elevated super-highway.

Besides revealing progress of the Route 25 improvement project, Commissioner Sterner also disclosed that plans for widening the Newark viaduct already have been discussed as the next step to aid in the further expansion of the area's industrial and business sections, shipping terminals and residential development.

Another important phase of the North Jersey construction program, is the new bridge now being built across the Passaic River between Newark and Kearny at a cost of $2,500,000. The new massive high level span, which is expected to be opened the latter part of next year, was sought as an urgently needed improvement to meet the transportation requirements of large industrial firms in the section.

Still another improvement in the program was the construction of the down ramp at the Newark end of the Pulaski Skyway, completed in 1938, at a cost of $67,000, to relieve dangerous conditions caused by trucks cutting across lines of passenger cars to reach the center ramp leading to the old Lincoln Highway.

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is a bucket that will keep the closing line UP out of the muck, save jammed sheaves and move yardage at a profit.

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Flood Control Legislation

Although protesting bitterly against the government budget's obvious dislike for flood control and river and harbor improvements, as reflected by steadily diminishing financial allowances for those internal developments, the waterways bloc by previous agreement made no effort to raise budget figures as the economy-minded House of Representatives today passed the non-military appropriation bill.

The bill carries $30,000,000 for Mississippi River flood control, $70,000,000 for general flood control, $42,421,510 for river and harbor maintenance, and only $24,300,000 for new river and harbor work. These figures are about one-third of the amount the Chief of Engineers reported he could expend economically in the next fiscal year. The bill now goes to the more liberal Senate for consideration.

A breakdown of proposed expenditures for Mississippi River flood control, as submitted by the Chief of Engineers and printed in the House hearings, is as follows:

Revetments	$2,400,000
Main line levees	4,800,000
Dredging operations	3,900,000
St. Francis River project	2,100,000
White River backwater levees	900,000
Yazoo River project	4,800,000
Rights-of-way	300,000
Morganza and Atchafalaya floodways	8,400,000
Atchafalaya River and Basin improvements	600,000
Wax Lake outlet and Charenton Canal	1,200,000
Surveys, gauges and observations	600,000
TOTAL	$30,000,000

The general flood control appropriation allows $197,000 for the Wallace Lake Reservoir and $223,000 for the Bayou Bodcau Reservoir, both in Louisiana; $750,000 for Wolf River and Noncomah Creek at Memphis; $1,198,500 for levees in the St. Louis, Rock Island and Chicago Districts; $14,283,000 for reservoirs and flood walls on the Ohio River, and the following sums for reservoirs in the Southwestern Division: $4,800,000 for Denison, $2,000,000 for Caddoa, $1,500,000 for Nimrod, $2,400,000 for Clearwater, $2,200,000 for Norfolk, $1,200,000 for Great Salt Plains and $2,250,000 for Fort Supply.

New Highways in Panama

Dirt is now flying on Panama's long 63-mile concrete highway, 20 feet in width, from the canal to the Rio Hato air field. A combined project of Panama, the Export-Import Bank and the U. S. Government, the highway will entail some $4,000,000 and is scheduled for completion in mid 1941. Included will be some 25 bridges, of which 20 or more are over 100 feet in length, the longest being about 230 feet. Good road engineering will be required to complete it in such short space of time but, as part of the Panama Canal improvements, it is slated as a "must" completion.

Another important road, the Trans-Isthmian Highway, is getting under way, with the recent transfer of $50,000 from the Panama Government to the canal authorities, for survey, grading and drainage work outside of Colon. Panama is to build sections of the road and canal authorities will construct other sections under terms of the new Panama Treaty. Because of old grants, the Panama Railway has had all transport rights across the Isthmus and, of course, the Trans-Isthmian highway is far from completed. The western (or southern end) is already open to the Madden Dam, after which comes 23 miles of jungle land over which surveys have been made but work plans not yet determined.

OBITUARIES

(*Continued from page 226*)

Robert Verrochio

Robert Verrochio, president and general manager of Lioni and Company, Limited, widely known Canadian excavating contractors, died March 9 in the Toronto General Hospital, at the age of 48.

Born in Sylvano, Italy, Mr. Verrochio came to Toronto when he was 18 years of age and became associated with contracting work. His ability in this field was soon recognized and in the remarkably short time of four years, he became associated with the present firm of Lioni and Company, taking an active part in the direction of its policies.

Among the outstanding projects of this company are the completion of such contracts as the excavating for the Globe and Mail building, the Bank of Montreal, the Ontario Hydro-Electric Power Commission building, and part of the Welland Canal.

Funeral services were held at the Roman Catholic Church of St. Mary of the Angels, Toronto, Canada.

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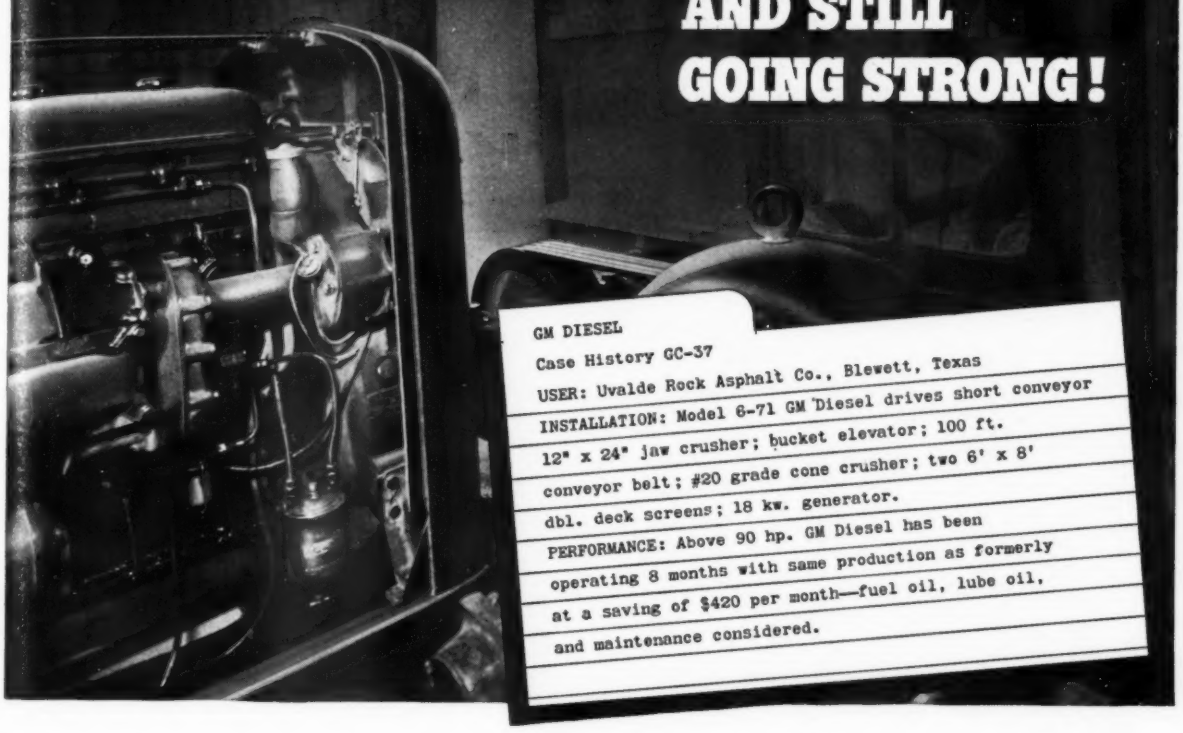

GM DIESEL
Case History GC-37

USER: Uvalde Rock Asphalt Co., Blewett, Texas

INSTALLATION: Model 6-71 GM Diesel drives short conveyor 12" x 24" jaw crusher; bucket elevator; 100 ft. conveyor belt; #20 grade cone crusher; two 6' x 8' dbl. deck screens; 18 kw. generator.

PERFORMANCE: Above 90 hp. GM Diesel has been operating 8 months with same production as formerly at a saving of $420 per month—fuel oil, lube oil, and maintenance considered.

THE case history shows what a job this Diesel is doing—and at what a whale of a saving!

Still, that's only part of the story. Consider the operating conditions—in Texas heat and rock dust. Its owners estimated it couldn't take it for more than three months.

But as this is written—eight months later—that GM Diesel is still pouring out its thrifty power as faithfully as ever. And as for maintenance, they haven't had to replace or remove even an injector!

You can imagine how pleased they are with performance like that—on top of savings that already total $3,360! They're so pleased, in fact, they're installing another GM Diesel in another crusher and hope to double those savings as a result.

Here is a typical example of the economy and dependability that have put so many GM Diesels to work throughout the engineering and construction field.

A major reason is the General Motors 2-cycle principle on which the GM Diesel is designed—a principle that offers better lugging qualities, more constant speed with varying load and is also easier to operate than engines of previous design. And due to its basic simplicity and its interchangeability of parts, service problems are conspicuously minimized—a particularly important feature in isolated locations. That's why it pays to specify GM Diesel power in your original equipment.

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Hiwassee Dam

(*Continued from page 217*)

mer mills in the secondary crusher building.

The secondary crusher plant contains a cone crusher and the hammer mills which produce the proper sizes of coarse and fine aggregate. The proportions of the various sizes produced is carefully controlled, but the material is deposited on the belt unsorted. This belt, Flight C, delivers the material to the elevated screening plant, in which the material is washed, screened, and dumped into stock piles over the reclaiming tunnel.

A conveyor in the reclaiming tunnel recovers the stored aggregate as it is required and delivers it to another conveyor which lifts the aggregate to bins in the mixer plant. The mixer plant is located near the top of the abutment on the north bank. Cement for the concrete is shipped by rail to the railhead at Turtletown and brought to the dam by trucks over the access road, a distance of 12 miles. The trucks used are 7½-ton Internationals fitted with aluminum cement tanks. At the dam the cement is stored in a steel silo near the river bank and elevated to the mixing plant as required by the Robinson pneumatic pumping system. The concrete mixing plant contains a battery of three 3-cu. yd. mixers which discharge directly into the cars of the concrete trains which run on tracks under the plant. All operations in the mixing plant have electrical controls. A refrigeration plant supplies the mixing plant with cooled mixing water. Dust collectors and fans protect the workmen from the dust hazard.

The concrete trains, hauled by Plymouth Gas-Electric Locomotives, carry the concrete from the mixing plant over a short transfer track to a position under the cableway where the material is dumped into a 7½ cu. yd. bucket. This bucket is handled by the 20-ton traveling cableway which spans the area of the dam and powerhouse.

Intensive Safety Program

Safety has been considered as of fundamental importance in the prosecution of the work on this project. The graywacke rock which is used in the concrete materials contains a high percentage of silica. There is a definite hazard from silicosis. Although the disease develops slowly, even under severe dust exposure, the effects are cumulative and may follow a worker from one job to another. As a means of dust control wet drilling is used in all phases of the project. Hoods and an air exhaust system for collecting dust from the crushing, screening, and cement handling operations are used. In addition, all employees are given an X-ray examination before starting work and their case history is reviewed to determine their previous exposure to silicosis. Periodic examinations are made to detect any indications of silicosis. The work of preventing silcosis is being carried out in close cooperation with the State Health Department of North Carolina and the United States Bureau of Public Health.

● This view of the quarry face gives an idea of the depth of the 9-inch blast holes which varied from 75 to 195 feet.

The safety program extends over all phases of construction. Attention is paid to minor details such as anti-slip treads on stairways, hard hats for men working where falling objects might land, and safety-belts when working in hazardous locations. Safety meetings and inspection trips have done their part in reducing accidents. That this program has well repaid the additional care required is evident in the low record of lost time accidents and the occurrence of only two fatalities.

● An "H" beam attached to the dipper of this Bucyrus-Erie efficiently dislodged loose boulders near the foot of the quarry face.

Large Scale Quarry Operations

The method of operation in the quarry received considerable study. Requirements for concrete aggregate production were estimated to be, in round number, about 2,000,000 tons. Preliminary drilling had revealed an extremely tough rock, so it was expected that costs would depend upon the rate of drilling rather than upon the facility of moving equipment.

Churn drilling was adopted in

line with modern quarry experience, particularly where the tonnage to be blocked out favors a high vertical face cutting back into a steeply sloping hillside. Jackhammers and wagon drills were used progressively in opening up a working face. The first churn drill holes were started with a depth of 75 feet or more, which increased to a maximum of 195 feet. It was planned to use these drills along the surface contours with a minimum amount of cribbing or trenching and so drill rigs skid-mounted were selected as most economical.

Tools for drilling 6″ and 9″ holes were purchased, but it was early demonstrated that 9″ holes would give better results and lower costs. Drilling speeds exceeded expectations and all drilling was completed early enough to permit the release of these drill rigs for other jobs.

Two 2½-cu. yd. electric shovels and four 12-cu. yd. trucks were selected to provide an even flow of material to meet the demand for concrete aggregate.

The original method adopted was to drive a center cut some 80 feet wide into the quarry area and work the side faces normal to the strike. Thus blasting operations would shoot rock out in blocks rather than in thin slabs, as the schistosity or flow cleavage joints roughly paralleled the strike which would then be perpendicular to the working face.

Subsequent quarry operations justified a change in the above procedure. The opening face was moved to the left end of the quarry and a cut driven straight back into the hill at practically right angles to the strike of the rock. As the face advanced it was widened on the right hand side and then extended farther to the right leaving a buffer ledge in front of the crusher to protect it from quarry blasts. The original or front face, and the right hand face back of the buffer ledge were then worked alternately, by shooting a row of holes the full width of the face at each round.

When shooting the front face the average spacing of holes was from 40 to 50 feet along the strike of the rock; the burden was from 22 to 24 feet. In shooting the right hand face, the burden was made heavier in relation to the spacing of the holes due to shooting across the grain of the rock; usually this burden was 30 feet, and the spacing was 25 feet. Fragmentation was usually satisfactory. Secondary drilling with jackhammers reduced large blocks to sizes which the shovels could handle. Contrary to expectations, it was found that the percentage of slab-shaped aggregate was not greatly affected by the direction of primary breakage; in fact, if there was a noticeable difference it was that blocks of rock put through the gyratory crusher fractured into slabs or slivers, whereas the slabs of rock were broken into cubical blocks.

More Shovels Called In

In December a Keystone drill model 84, electric motor driven, was purchased and put in operation. Two Bucyrus-Erie shovels, model 75-B, electric, were transferred to Hiwassee from other TVA jobs; shovel No. 6 came

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● Blasted graywacke rock is loaded to Linn tractors by the Bucyrus-Erie during apron excavation operations.

from Pickwick Landing Dam and No. 7 from Chickamauga Dam. As soon as shovel No. 6 was received it was assembled and erected so that a week later the 75-B started operations. A crane boom was assembled on the shovel and this equipment was used for installing the primary crusher. When the crusher was assembled, the shovel boom was installed on the 75-B in order to commence the excavation along the quarry face. This shovel loaded 12-cu. yd. Hug dump trucks for the short haul to the temporary crusher which was still in use. The removal of overburden was comparatively a simple matter. Hand crews rolled loose rock from above the quarry face and a Linn tractor pulled the heavier boulders down with a cable. A small amount of overburden was sluiced down, and a plank trough was constructed to divert this sluicing water and material around the crusher. Two Chicago Pneumatic Tool Company wagon drills, equipped for wet drilling with air were used, in addition to the large drill, in preparing for the first big blast to open the quarry face. The Koehring, Shovel No. 3, was used to clean up the face, while the Bucyrus-Erie shovel was used to side cast the overburden accumulated on the quarry floor.

The test run in the new primary crusher was made on January 14, 1938. The big Bucyrus-Erie loading into Hug trucks, now started to work in earnest. The Linn tractor continued to snake large rocks off the quarry top during stripping operations. Spoil which had been sluiced down the slope and accumulated on the quarry bench was removed by the shovel by side casting. Drilling with the churn drill and two wagon drills continued steadily. Due to the steepness of the slope a timber crib was necessary for the wagon drill, though jackhammers were sometimes used to cut out a bench for the drill.

In March, 1939, two new Bucyrus-Erie drills were received and assembled at the foot of the quarry road. These drills were model 29-T blast hole drills, equipped to drill either 6- or 9-in. holes. A drill bit resharpening shop was built at the top of the quarry face. Bits were taken between the drills and the shop in a shop-made buggy operated with an air hoist. This buggy ran on a plank trough built up the side of the quarry.

When the second Bucyrus-Erie shovel was put in operation, the quarry working floor was widened to permit faster trucking and loading. The churn drills commenced working three shifts, while the shovels and trucks worked two shifts. Soon the quarry face was opened sufficiently to permit better working conditions. The rock drills which had been drilling 6-in. holes 25 feet on centers, 20 feet back from the face, now started with 9-in holes. The 9-in. holes could be drilled more rapidly than the 6-in. holes, and carried greater burden and were spaced further apart. The blasts obtained with the 9-in. holes were more satisfactory than with the 6-in. holes therefore all further drilling was done with the larger bits.

Loading Blast Holes

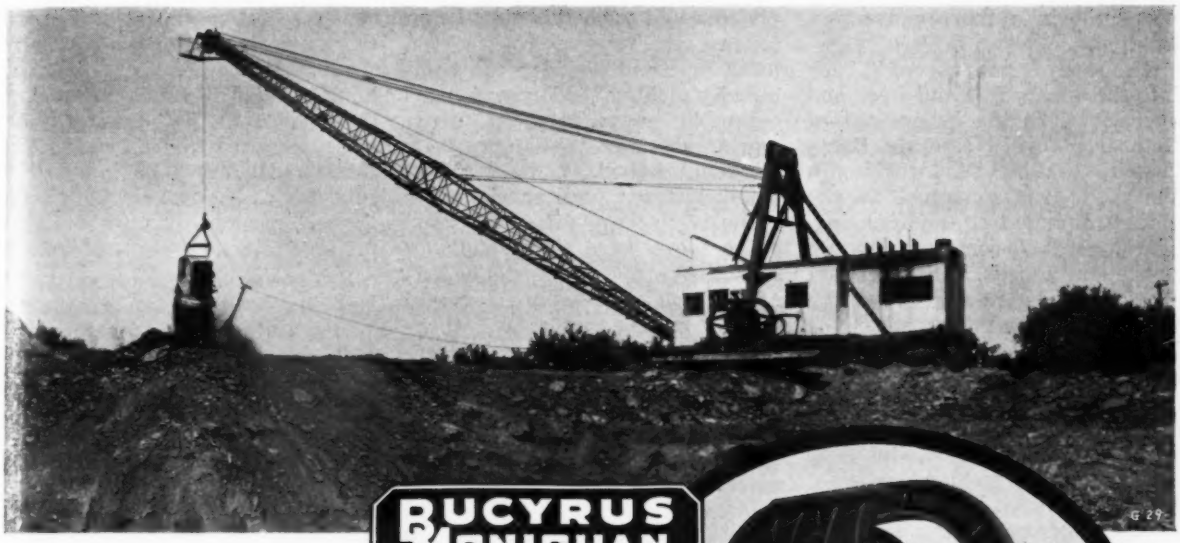
Nitramon quarry explosive (ammonium nitrate) manufactured by duPont, packed in waterproof tin cans, was used in the main blasts. Nitramon A, B, and C was used; these explosives compare with gelatine compounds equivalent in strength of 50% to 75% dynamite. Primary blasts were fired with Primacord or Cordeau detonating fuse. The 9-in. holes were usually loaded solid with 8½ cartridges to within 30 or 35 feet of the top.

An average of 75 tons of rock has been blasted out per linear foot of 9-in. hole. Along the north face, parallel to the strike, 3.79 tons of rock was removed by a pound of explosive; along the east face, the yield averaged 2.58 tons per pound of explosive.

A long crib bulkhead was constructed along the west side of the crusher to protect the plant during the blasts. For dust protection a hose sprinkler was used to soak thoroughly the rock in front of each shovel. A dust collector system was built at the primary crusher to remove dust from around this operation. A spray over the crusher wet down the rock as it was dumped from the truck.

In July, 1938, Shovel No. 7 was moved down to the cofferdam for excavating the spillway apron. Shovel No. 6 continued loading out rock in the quarry. When the Hug trucks were required on other work the Linn tractors were used in the quarry. A core drill was moved in from Guntersville for additional exploratory drilling. It is the policy of the Tennessee Valley Authority to move equipment from the various jobs to where it may be most economically used.

Ordinarily work continued only five days a week. Occasionally the quarry work was performed on Saturday and Sunday to adequately supply the mixing plant. One wall of the old dynamite magazine, in which the walls were filled with wet sand, collapsed due to the wet sand rotting the studs. A new magazine constructed of creosoted timbers for studding



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was built in a more convenient location.

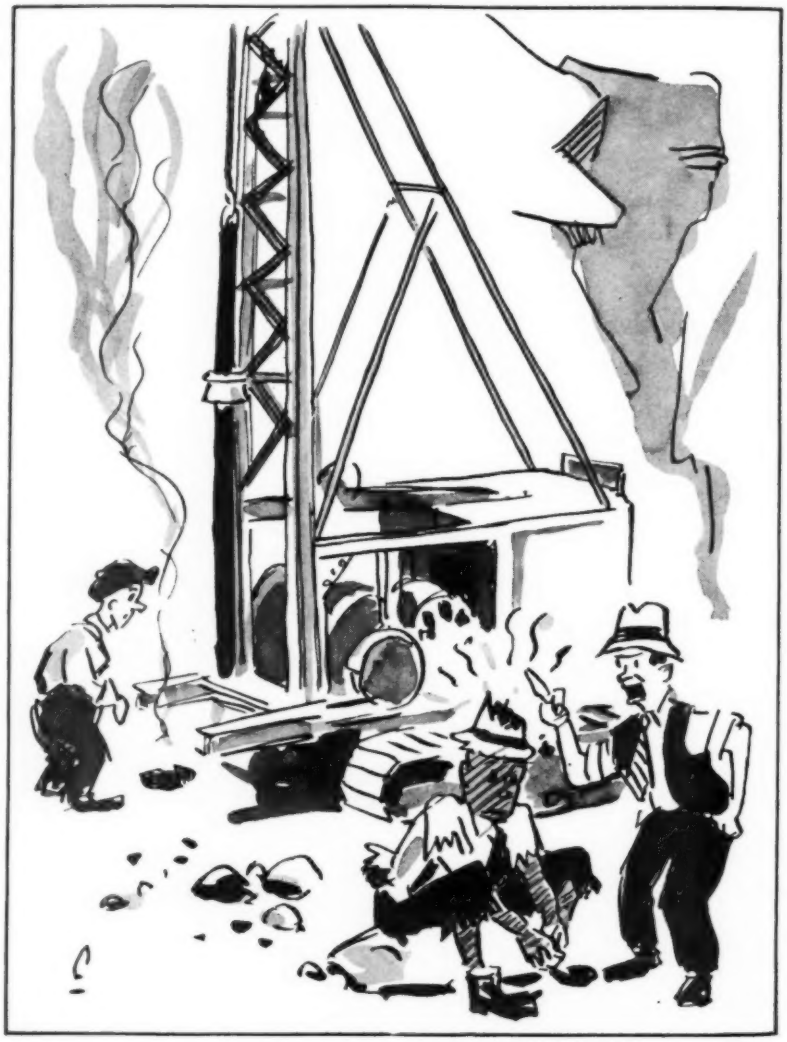
The Koehring was brought back into the quarry to avoid week-end operations. In the latter part of October, Shovel No. 7, the Bucyrus-Erie that had been working in the cofferdam, returned to the quarry, augmenting the Koehring. The two shovels continued loading to the Hug trucks. Two 12-cu. yd. Hugs served each shovel. Quarry work was slowed down when the blast piled the loose rock too high. During the operations two shovels and four trucks worked two shifts a day. Primary blasts consisting of a round of from six to ten 9-in. holes, usually yielded sufficient tonnage for four weeks' operation. Secondary drilling was done with the Ingersoll Rand, model S-49, air jackhammers, wet type, and secondary blasting was done with 40% dynamite, exploded with electric blasting caps. Quarry operations were so adjusted as to balance the demand of the mixing plant for aggregate. Churn drilling of the 9-in. holes was pushed as rapidly as possible so that in April, 1939, all the rock drilling was completed and the drills moved off to another job.

153,000 Ton Blast

The largest blast shot brought down 153,000 tons of rock with 45,500 lb. of explosives. In cleaning holes preparatory for the larger blasts, the hole was filled with water and an air line run to the bottom of the hole. Air was turned on and pressure built up suddenly, exploding with a rush, taking out all dirt and refuse. Air alone merely churned up the material in the hole and did not blow it out. Ordinarily the holes were loaded heavily enough to throw the rock well out onto the quarry floor. In one or two cases the loose rock was piled very high, due to the fact that a major blast disclosed a badly cracked or overhanging face. To prevent working under this hazard, a second blast was shot to bring down loose rock. The most effective method discovered to dislodge heavy boulders piled high on a working face was the use of a long "H" section steel beam fitted with a hanger to go over the teeth of the bucket of the Bucyrus-Erie. The shovel operator could push this steel beam against overhanging rock in the loose face and dislodge the boulder. By picking the key rock, considerable material was often worked down to the quarry floor by this method. A wagon drill fitted with a swivel carriage for stope drilling was effectively used when there were heavy boulders near the bottom of the slope. This stoper drill was used ordinarily to cut out the toe of the face whenever a blast left a solid toe.

As of September, 1939, 1,650,000 tons of rock have been blasted from the quarry. This represents 259.8 gross tons per net hour of work. Net hours are actual operating time taking out time lost due to blasting, breakdowns, and shutdowns. Normal operation consists of two shovels and four trucks working. For the month of August the gross tons per net hour equaled 347.5 tons. During this month 112,387 tons of rock were delivered to the crusher. In this month only 0.83 hours lost time (delays) were chargeable to shovel breakdowns, which was 0.2% of the total shift hours.

Hiwassee Dam was designed and is being built by the Tennessee Valley Authority, under the general direction of Theodore B. Parker, chief engineer; A. L. Pauls, chief construction engineer; and H. A. Hageman, chief design engineer. At the dam, C. E. Blee is project engineer; O. Laurgaard, construction engineer; and J. E. Walters, construction superintendent.



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Trade notes

The R. B. George Machinery Company of Dallas, Texas, and the R. B. George Tractor and Machinery Company of Amarillo, Texas, with branches at Tyler, Abilene, and Lubbock, have been appointed distributors in the northern half of Texas for Bucyrus-Erie ⅜-yard to 2½-yard shovels, draglines, clamshell and lifting cranes. By adhering to a definite policy of supporting their sales with the finest service, these two companies have built up in the 24 years of their existence one of the largest road machinery businesses in Texas. Customers and prospects for Bucyrus-Erie ⅜ to 2½-yard machines in the southern half of Texas will continue to be served by the Gulf Tractor & Equipment Company, Houston, and Tri-State Equipment Company, El Paso. All Bucyrus-Erie distributors in Texas work with the cooperation of E. B. Chambers, Bucyrus-Erie representative in Dallas.

Through a recent transaction The Buckeye Traction Ditcher Company, Findlay, Ohio, now owns all Emsco tractor equipment patents, also those patents under which Emsco was licensed or had working agreements and all Emsco application for patents.

Wm. H. Schomburg, Executive Vice President of Buckeye, also announces that this tractor equipment is being manufactured at Findlay, Ohio, exclusively and that sales are being handled from the Buckeye general office in Findlay.

A new plant for the large-scale production of pre-fabricated concrete building units by new principles of manufacture is being built in Pittsburgh by The Cemenstone Company, it is announced by L. M. Johnston, president of the company. Mr. Johnston states that the wide acceptance of Cemenstone products has necessitated removal to a location which will permit acreage for necessary expansion.

In addition to manufacturing its products The Cemenstone Company has also formed its own sales organization.

A new ultra modern laboratory and research building is rapidly being finished for Cummins Engine Company, Columbus, Indiana, well-known builders of automotive, marine and industrial full diesel engines. The finished building now under construction by the Austin Company, Indianapolis, and company officials claim it will be one of the most modern rigid frame "whale back" types built today.

Book reviews

When writing to manufacturers and publishers please mention Excavating Engineer.

Drawing upon their experience and upon important research conducted by the American Institute for Economic Research, Bion H. Francis, head of the insurance division, and E. C. Harwood, director of the institute, have collaborated in writing an important book, namely, "Life Insurance from the Buyer's Point of View," including a discussion of annuities, accident and health insurance.

Recommended by the Book-of-the-Month Club and Consumers' Research, this book is intended especially for the man who, although he has no training in the life insurance and annuity field, wishes to own the best contracts at the lowest cost. This new 260-page publication can be obtained by sending one dollar to the American Institute for Economic Research, 54 Dunster Street, Harvard Square, Cambridge, Massachusetts.

Entirely devoid of inflated terminology, "Geology for the Layman," written by Alexander MacLean, Professor in the Department of Geology, University of Toronto, will serve as an introduction to the science of geology. It has been prepared especially for the instruction and guidance of prospectors, students, engineers, executives and investors. Printed in clear, legible type, profusely illustrated, indexed and bound in attractive, durable leather, this book makes a valuable addition to the library of everyone interested in mining. The price is $2.00. For further particulars write to the Northern Miner Press Limited, 122 Richmond Street, West, Toronto, Canada.

The 1940 edition of Canadian Mines Handbook, published by the Northern Miner Press Limited, 122 Richmond Street, West, Toronto, Ontario, Canada, has just been issued. The facts contained in the 1940 edition of this publication have been compiled by a review of 5,713 companies as compared with 5,526 companies in 1939. As usual the first section of the handbook is devoted to companies which were active or which were formed during the last year. Other sections mention in less detail corporations and syndicates which were relatively active, or became or continued inactive. The price of this book is $1.00.

The new Lincoln 200 Ampere "Shield-Arc Junior" engine-driven welder, with current rage of 40 to 250 amperes, is introduced to you in the new bulletin published by the Lincoln Electric Company, Cleveland, Ohio. The welder can be used for the welding of light gauge metal, for the repair of cast iron parts, for the fabrication of machine parts and structures of many kinds and for hard-facing of worn parts.

National Coal Publications, W. C. MacQuown, Owner, announce the release of the latest editions in their new series of publications, MacQuown's "Proximate Coal Analyses—District Board Analyses." These cover District Number Eight (Southern High Volatile) and District Number Nine (West Kentucky).

Orders, or inquiries for information, should be addressed to National Coal Publications, Law Bulletin Building, Pittsburgh, Pennsylvania. Books will be sent, upon request, to responsible indi-

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viduals or companies for five days' free inspection.

A new Haiss bulletin, just announced, brings to notice the 1940 refinements added in the way of: 1—hinge pins of increased diameter, 2—heavier jaw plates, 3—teeth of a design evolved out of special field studies in various kinds of digging. Copies can be had from the George Haiss Manufacturing Company, Inc. of New York City.

Koppers Company, Bartlett Hayward Division, Baltimore, Maryland, has just issued a booklet describing its new Fast's Multiple Oil Film Bearing for which United States rights were obtained last summer from Gustave Fast, famous designing engineer, who also designed the Fast's coupling which Bartlett Hayward has manufactured for many years.

The booklet outlines the history of bearings, discusses the principle of Fast's bearing, describes and illustrates its design, provides tables of dimensions and load capacities, dimensions of standard bearing housings, recommended shaft sizes, dimensions of lock nuts and proper oil levels.

A completely illustrated 8-page Bulletin on M.S.A. Eye Protection for every job in industry has just been published by the Mine Safety Appliances Company. A front cover in newspaper form presents impressive statistics of the cost of eye injuries to industry, and features the qualities of the various types of M.S.A. protective lenses. In succeeding pages are described a complete line of goggles and spectacles, welding helmets and shields, combination protective hats with welding shields or goggles and several additional new items. Copies of this Bulletin No. CE-8 may be obtained free on request to this publication or direct to Mine Safety Appliances Company, Braddock, Thomas & Meade Sts., Pittsburgh, Pennsylvania.

Continuing its policy of periodically publishing sales literature of a helpful, educational kind, the Mechanical Goods Division, United States Rubber Company, has recently issued a 34-page booklet entitled, "U. S. Hose Hints."

As its name implies, the booklet is designed to enable customers to get more service out of the various types of hose used, and to help select the correct hose for specific purposes. In addition it contains information in the form of tables, etc.; illustrates the various kinds of hose construction; lists various hose terms; methods of making hose; and explains how hose is tested before it is placed on the market.

The latest publication of the Macwhyte Company, Kenosha, Wisconsin, was written specially for use by all people concerned with handling problems where slings are employed. Containing 56 pages of information, the handbook on slings contains many reference tables and photographs.

According to the Macwhyte Company, copies of the new Sling Handbook may be had by simply writing, on company letterhead, giving name and title, to Macwhyte Company, Kenosha, Wisconsin.

A new bulletin, "101 Welding Ideas for Low Cost Maintenance," which illustrates and describes a wide variety of money-saving repair, fabrication and structural applications of arc welding, has just been published by The Lincoln Electric Company, manufacturers of arc welding equipment and electrodes, Cleveland, Ohio. Copies are available.

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